Popular Science Monthly

239 Fourth Avenue, New York City

Vol. 90
No. 2

February, 1917

$1.50
Annually

Safety Searchlights For Firemen

Fire rescue operations simplified by the use of a new lamp which gives the fireman the free use of both hands

IT is obvious to anyone familiar with fire-fighting that a lighting equipment which will enable the fireman to see his way in a gas and smoke-filled room and at the same time allow him a free and unobstructed use of the hands and arms would meet with instant favor. At the present time the fireman uses a simple oil-burning torch or acetylene lamp which he carries in his hand. His efficiency as a fire-fighter is, of course, greatly lessened, since he has the free use of only one hand.

A new searchlight tested by the Cincinnati fire department and now adopted as a part of the standard equipment of that department, may yet supplant the torch and acetylene lamp. The lamp is strapped on the back of a fireman. The burner or lamp extends above the fireman's head, and an extension allows of adjustment, so that the fireman can direct the rays of the lamp in any direction desired. The device weighs thirty-two pounds.

The searchlight is intended to be of greatest service in fires where rescue work has to be carried on. The fireman equipped with it has his arms free to use as he wishes. In entering a burning building where the dense smoke makes it impossible to use a small light, the new lamp would be of great assistance. It cuts a clean swath of light through the densest smoke, permitting the members of a rescue squad to carry on their work with safety and dispatch.

The new lamp is fastened on the back of a fireman with a strap resembling suspenders. The burner extends above his head

The drawing on the opposite page vividly illustrates the use of the new lamp by firemen carrying on rescue operations in the hold of a ship where the smoke and gases are particularly thick. Fortunately, the hold is high enough to permit the firemen to work with the new lamps without bending their backs to clear obstructions. The fireman in the foreground can thus climb the ladder with a suffocated boy in his arms—something which would be extremely difficult to do were he obliged to hold on to a hand lamp at the same time.

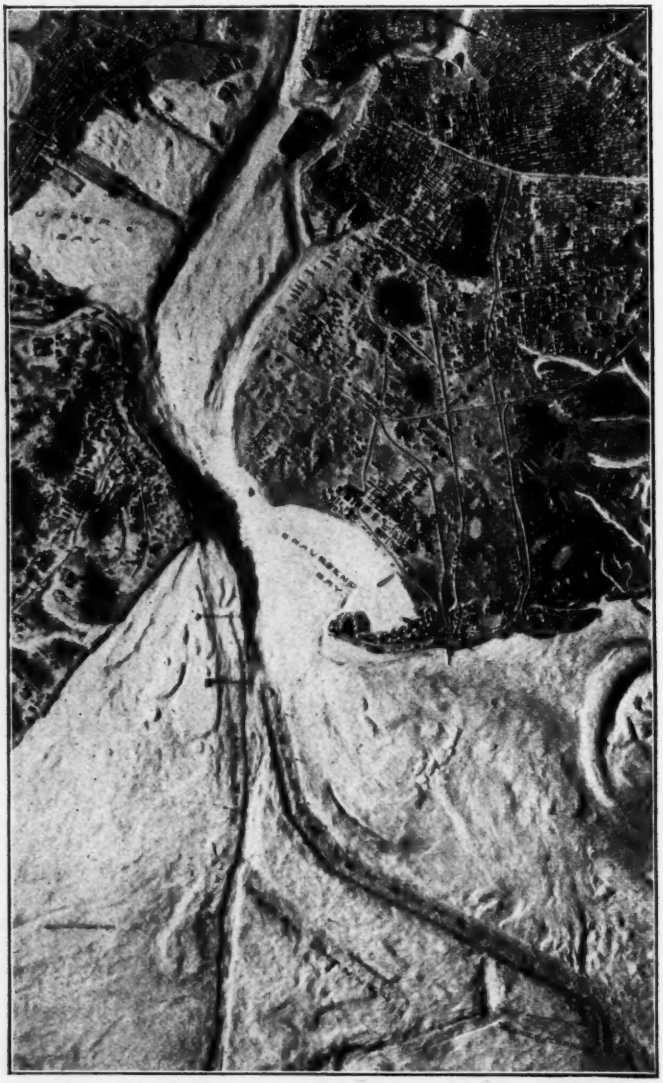
The principal objection to the lamp is found in its excessive height. In New York, for instance, most fires of a gaseous and smoky nature occur in cellars with ceilings so low that the firemen are obliged to crawl instead of walk in them. This is especially true of sub-cellars, which are so low as to eliminate at once the use of such lamps unless the wearers are willing to undergo the inconvenience of constantly bending their backs.

On the other hand, it is said that no lighting apparatus ever will take the place of the hand lamp for the reason that it is, after all, the most convenient means of directing a ray of light to a desired spot in a minimum of time. True, the new lamp can be focussed in any direction, but not until the man wearing it reaches behind his head and adjusts the arm. Another objection to the new lamp is that falling objects could easily sever the lamp from its stem.

Suppose New York's Harbor Were Drained

It would look like the picture below and show the deep channels dredged for great trans-atlantic steamships

THE accompanying illustration shows how New York Harbor and vicinity would look if all water were drained off. The deep channel of the Hudson River is shown and the exact shore line of New Jersey and lower New York is vividly outlined. But the most interesting single feature is the location and shape of Ambrose Channel, which is the largest artificial harbor entrance in the world. It is through this channel that the great ocean liners must pass to and from New York.



The three black lines at the extreme top represent Williamsburg, Manhattan and Brooklyn bridges. The black spot below them is Governor's Island and the Statue of Liberty is on one of the little islands to the left. Coney Island is the stretch of land lying directly below Gravesend Bay

Ambrose Channel is seven and one-half miles long, two thousand feet wide, and forty feet deep at mean low water. Sixty-six million cubic yards of material were removed in making the channel, and the cost to the Government was four and one-half million dollars.

The cost of upkeep is even more astounding. Each year the Government spends ninety-five thousand dollars alone in guarding the channel to prevent it from being clogged by illegal dumping. Because the dumping scows must pass far out to sea to dump their loads of rock and debris there is a great temptation on the part of dishonest captains to dump wherever convenient. For instance, the amount of dirt and rock dumped at sea during the past twenty-five years would build seventy pyramids the size of the great pyramid of Cheops in Egypt. The increase in late years has been fourteen million cubic yards. Is it any wonder, then, that the Government is so vigilant in its patrol that it forbids tugboat captains to dump the ashes from their own engines in Ambrose Channel?

To the individual such an injunction seems arbitrary; but an aggregate of all the ashes from all the tugboats that enter the harbor would present a formidable problem.

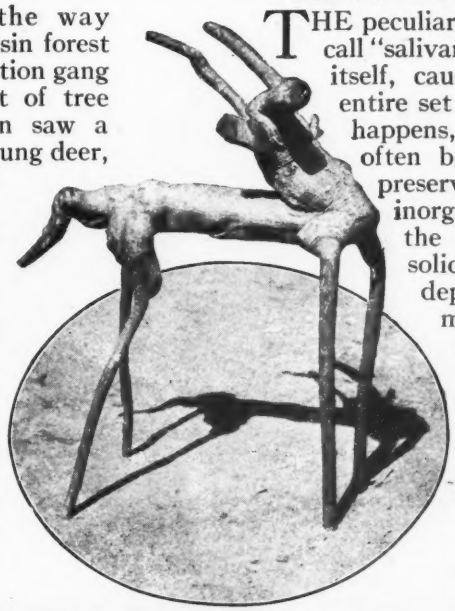
What the First Aerial Bombs Were Made Of

IT may be remembered that Garros came to the United States in 1911 and amazed vast audiences by his audacious flights. From here he went to Mexico to entertain the populace there. It occurred to him on arriving that, since fighting seemed to be the favorite pastime of his Latin brethren, he would making a lasting "hit" with them if he could only arrange for an aerial sham-battle. To his good luck, he found the general in command of the army, then in Mexico City, a willing listener. Accordingly, one day he was seen flying over the Mexican batteries, armed with baskets of juicy oranges that the quartermaster had given him. Suddenly the batteries opened fire and sent shot after shot after him. The immense crowd became wildly enthusiastic, although they knew, of course, that only blank cartridges were being used. Garros then started to let go the oranges upon the artillerymen. To his surprise almost immediately they began to scatter in every direction. The quartermaster had not realized that a juicy orange dropped from so great a height would rival a small bomb. The first aerial fight unquestionably was won by bombs of ripened oranges.

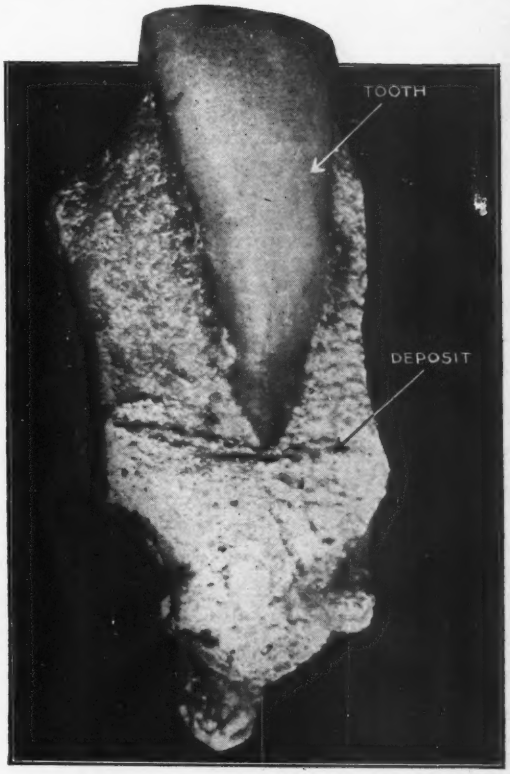
A Tree Root That Resembles a Young Deer

WHILE clearing the way through a Wisconsin forest for a railroad, a construction gang pulled up a curious bit of tree root. One of the men saw a resemblance in it to a young deer, and accordingly took it back with him to camp. Merely by cutting away the surplus branches, the root was formed into a fairly good-looking deer; that is, if such matters as a bandy-leg and full-grown horns may be overlooked as desirable members of a very young deer. The eyes, nose and ears were formed by the knots when the branches were cut away.

The deer stands three feet high and is a prized curiosity.



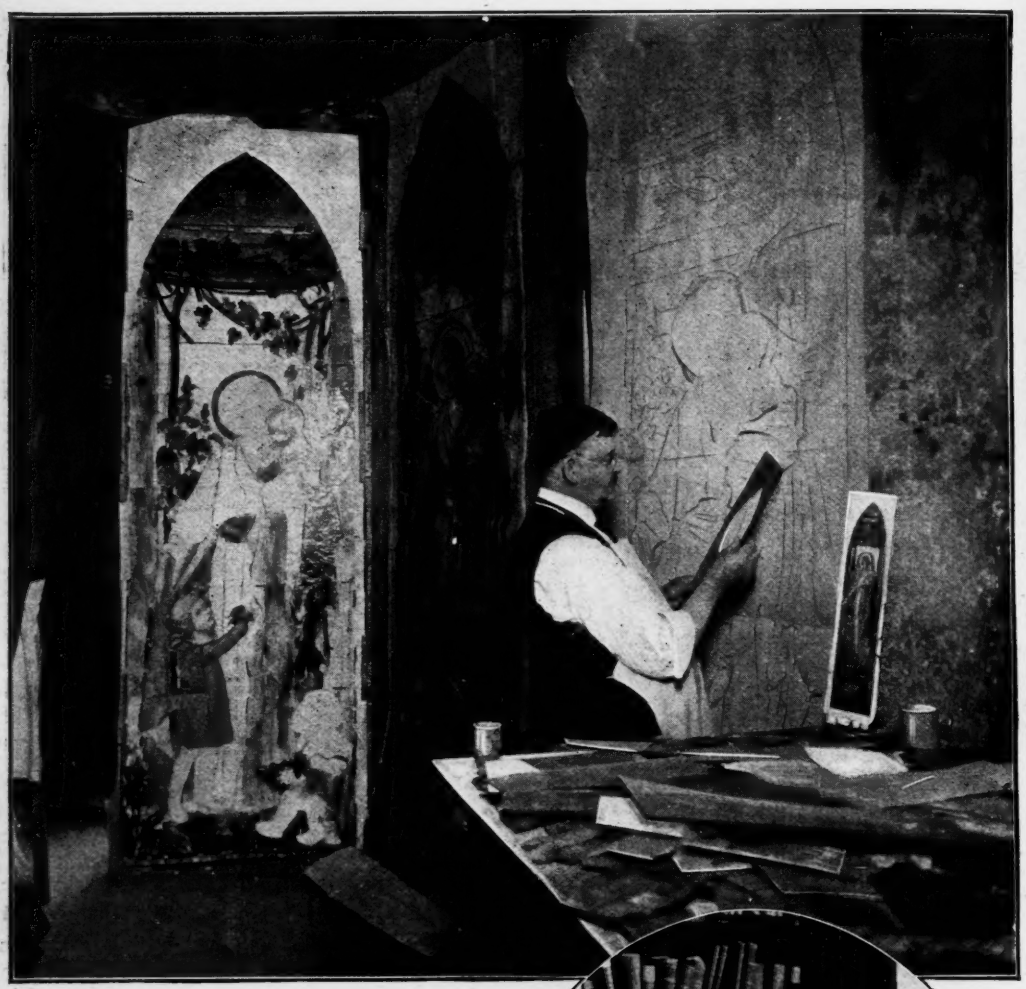
Woodsmen in a Wisconsin forest found this curious tree-trunk which they imagined resembles a very young deer



An incisor tooth covered with a solidified matter which has eaten the gum away but has preserved the tooth from bacteria

A Peculiar Disease of the Teeth Which Disables and Yet Preserves Them

THE peculiar infection which dentists call "salivary calculus" will, if left to itself, cause a person to lose his entire set of teeth. Yet when this happens, the teeth themselves will often be in a perfect state of preservation. The organic and inorganic matter, derived from the saliva in the mouth, solidifies and forms a hard deposit upon the teeth. The mechanical irritation of the deposit causes the gums to become exposed to chemical deterioration of the salivary deposit. The deposit then absorbs the gum tissue and interferes with the building up processes of the bony roots, so that the teeth finally become completely exposed and must drop out because of their lack of support.

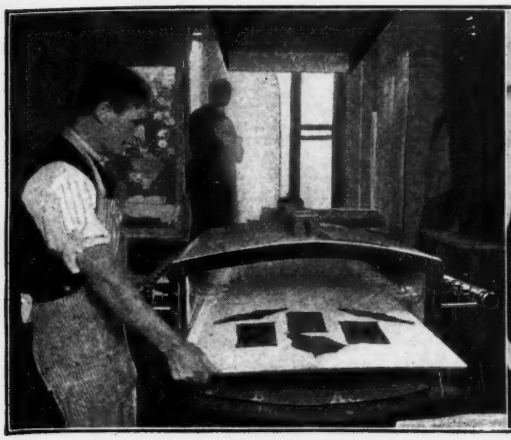


© Press Illus. Serv.

The photograph above shows the various stages in the making of a stained-glass window. On the table is a small sketch of the window first submitted to the customer. The worker is standing in front of the large outlined drawing from which he secures his patterns. At the left is the window itself partially completed

Painting a small face on a slab of glass which has been cut to fit into a large window. The artist first makes a rough sketch of the figures. This sketch is later removed and a more accurate one, made in careful proportion, is substituted. The glass then passes into the hands of the artist who works with paint and brush

Angels and How They Are Created



Pieces of painted glass being fired in a kiln. The glass remains in the kiln for several hours and if the exact shade is not obtained it must be fired again. This is an antique method but no modern way has superseded it

At right above: When each tiny part of the pattern has been covered with a corresponding piece of colored glass, the pieces are cemented into place with lead and the completed pattern is then very carefully polished

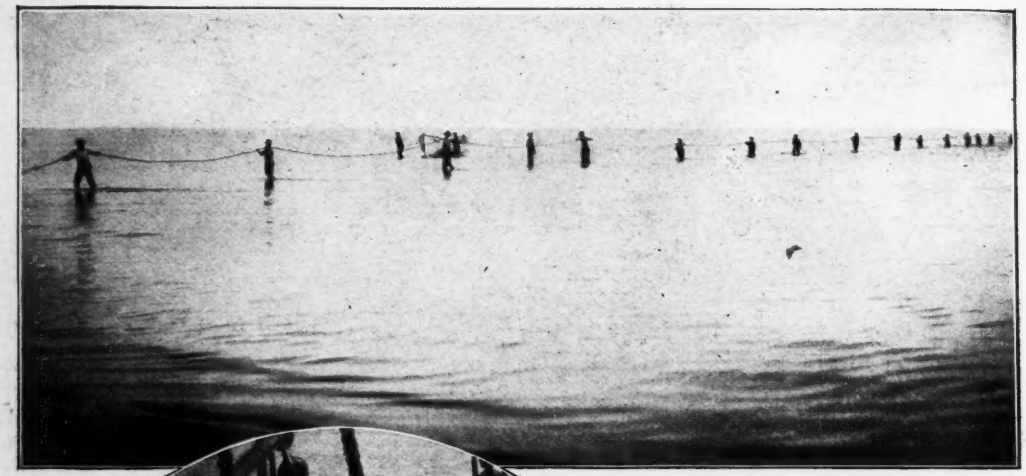
At right: The central panel is a large stained-glass window. This panel appears in its finished form. The photograph immediately below shows an artist working on it

Putting the final touches on the panel shown above. The artist is working with the panel attached to the window in order to judge the light effects. At the right of the panel is a chart upon which is accurately outlined the various parts which go to make up the finished piece. The artist constantly refers to this in painting her figures

© Press Illus. Serv.

At left: Fastening the small pieces of stained glass to the plain glass with gum. This is a slow and laborious method, but it gives the window-maker the first definite idea of what his window will look like. Later the pieces of stained-glass are leaded in

Cable Laying as the Signal Corps Does It



One of the important vocations taught in the Signal Corps school is cable laying. Above is shown a shore-landing party of the cableship Burnside towing the cable to shore in shallow water. Once on shore a trench is dug and the cable is led to the station

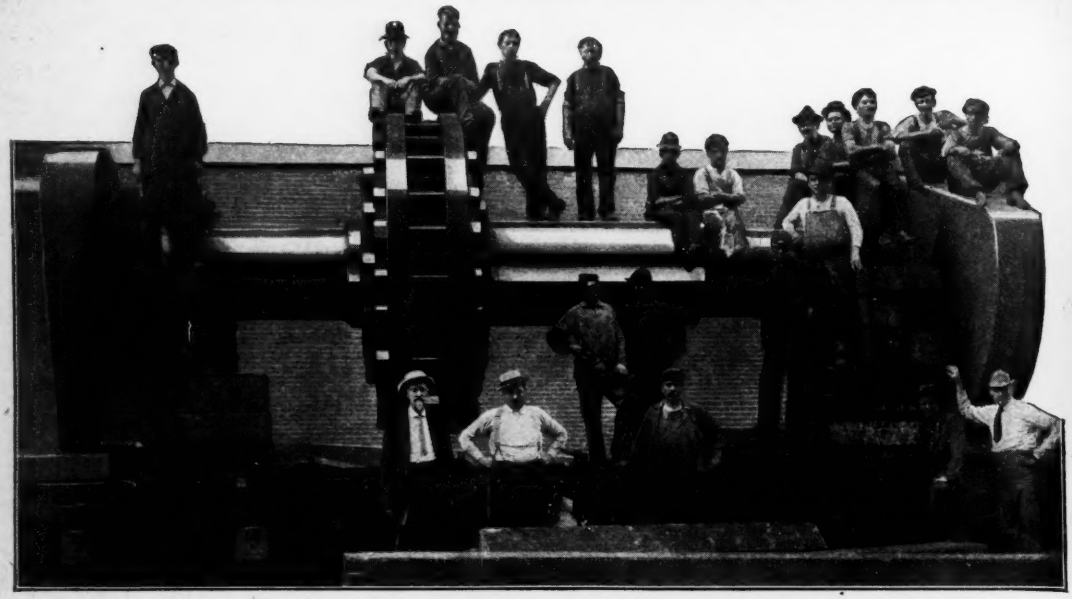
At left: A Signal Corps cableman securing the cable before casting from the grapnel or anchor. Should the cable part from its moorings it would not only necessitate great expense in an attempt to recover it but the chances of so doing would be remote

How a cable looks when its covering is removed. To give it strength each cable is composed of a large number of small steel threads wound and twisted and sometimes interwoven. No cable is stronger than any one of its threads. Were one thread to break, additional strain would fall on threads adjacent to it causing them to break and finally destroying the whole structure of the cable

Straw Umbrellas for Chrysanthemums

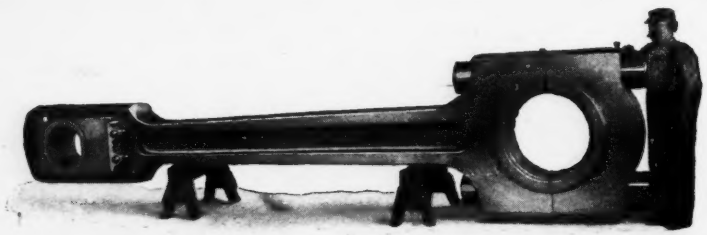
The chrysanthemum, the great big, brilliantly beautiful first cousin of the simple field daisy. has sprung into favor throughout the civilized world. It is the flower of flowers during the autumn season, even in parts of the world that we hear little about. French horticulturists are particularly adept in growing it, taking infinite care in perfecting it. The photograph shows two rows of chrysanthemums with straw umbrellas to protect them from the frequent frosts of autumn. Frost turns the tips of the petals black, thus destroying their beauty

First the White-hot, Flowing Metal, Then the Mold,



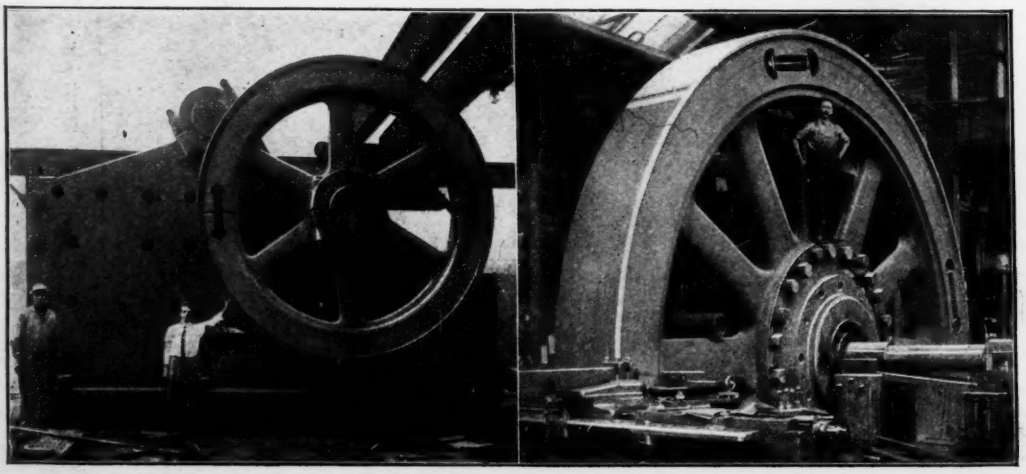
A ninety-ton steel crankshaft for an electric power-house engine loaded on a pair of big gun trucks. Compare this with the automobile crankshaft from a sixty-horsepower motor. The bolts are to secure the flywheel in place

Below: Connecting rod for a large steel-mill engine. Note the size of the nuts on the bolts in the end where the man stands. The connecting rod of a sixty-horsepower automobile is shorter than the crank-pin bearing



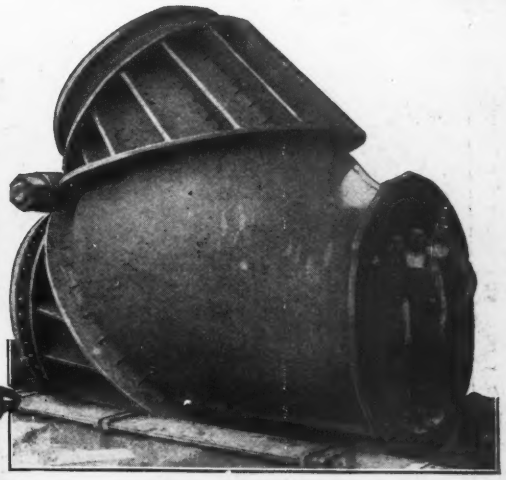
Below: Rock crusher weighing 480,000 pounds, capable of crushing rocks as large as pianos at the rate of a thousand tons a minute. It is made almost wholly of steel castings

Below. A flywheel weighing 120 tons which is nearly thirty feet in diameter. It was turned and made round and true in a great pit lathe. It is mounted on a 90-ton crankshaft



and Lastly the Iron Monsters From the Mold

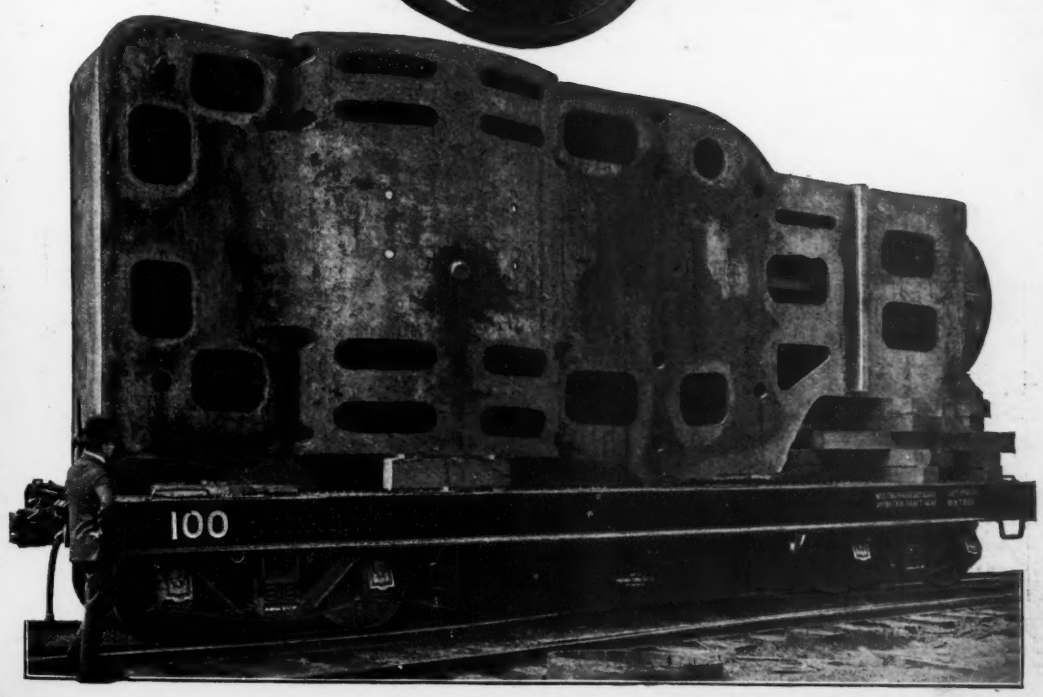
A ponderous bevel gear nearly fifteen feet in diameter. Note the accuracy of the measurements as compared with the hugeness of the casting. It weighs exactly 32,000 pounds



Cast steel "lateral" or branch joint for a huge pipe line, loaded on a special car built without a floor so that the casting would clear bridges, tunnels and other railway obstructions encountered

At right: A ten-foot "butterfly" valve large enough for a limousine to drive through. The gate is swung by means of an electric motor which operates on powerful gearing

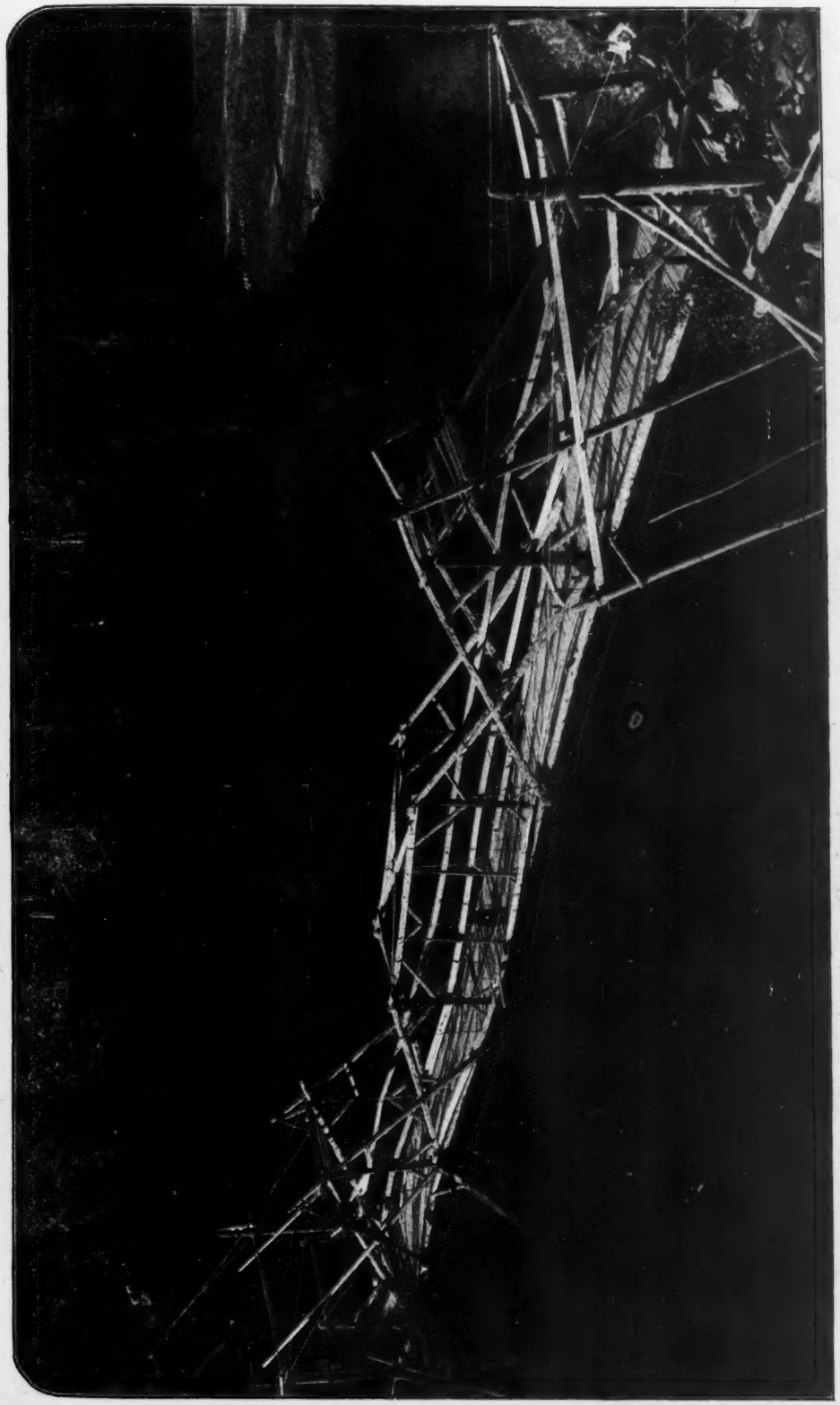
Below: The bottom of an engine bed-plate weighing 86 tons, cast in a single piece. It is loaded on a steel flat-car built especially for such heavy burdens, ordinary railroad rolling stock being too light



One of the Strangest Natural Freaks—A White Negro

The old man in the photograph is an albino Bush Negro. His skin is dead white and his eyes are pink. Although nearly blind he is an expert boatman and woodsman. His little grandson, who was included in the photograph for the sake of affording a vivid comparison, is jet black

Another Chapter in a Forgotten Telegraph Fiasco



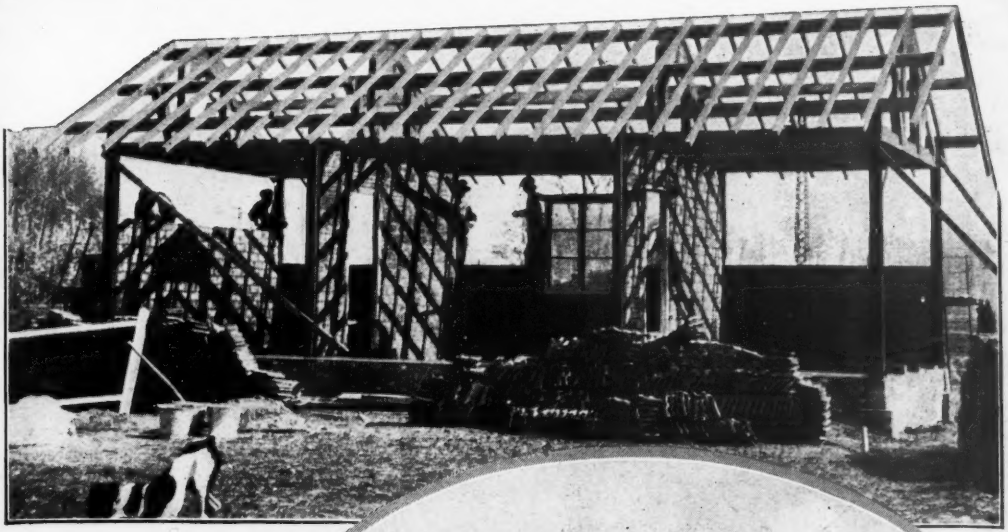
A unique suspension bridge across the canyon of the Helguilgate in the Fraser River Valley, in British Columbia, built by the Indians with telegraph wire and poles abandoned by Colonel Bulkley in 1866. It combines the three principles of bridge construction—cantilever, truss and suspension. Its discovery and the finding of a huge cache of copper wire recalls the bold project conceived fifty years ago by the Secretary of War, Mr. Seward, to link Washington with Petrograd and other important European capitals by an overland wire line

Building New Cities of Demountable Houses on

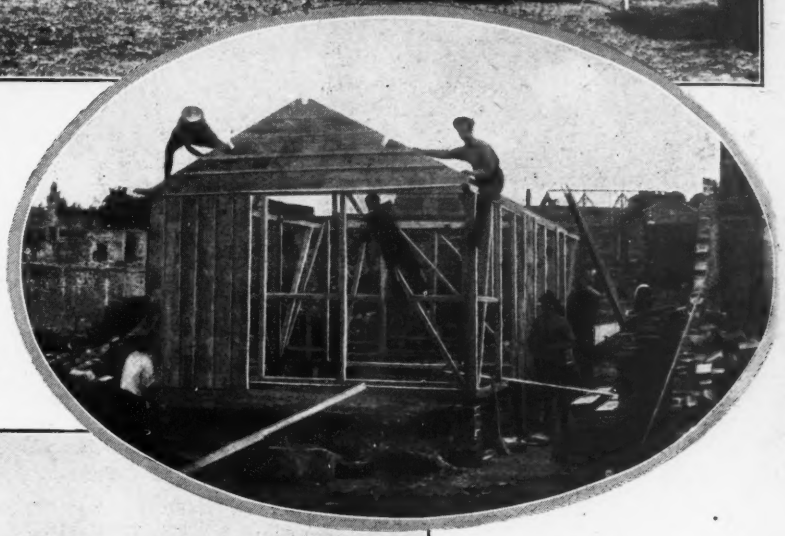
The period of reconstruction in the devastated and depopulated sections of France was under way when the smoke of battle was still in the air. To-day the ruins of villages centuries old serve as the foundations for newer villages of light frame buildings and demountable houses. The English society of "The Friends" has undertaken this relief work of supplying homeless French families with the ready-cut lumber to build their temporary homes. At left is shown a ruin under investigation. The agent will decide whether the walls that are standing may be used again or whether an entirely new structure will be necessary

The height of good fortune—a horse to help! Here the builders have tiles with which to construct their wall. They have already begun to set up the framework for their future home

the Ruins of Ancient Villages Destroyed by War



Above: A dwelling with the roof framework completed and some of the tile walls in place. Since the wood comes in pieces already cut to fit together it requires but little ingenuity to place it correctly. Six or eight men are required to set up each house



A small dwelling house appears in the oval above. There are thousands of such temporary structures in France at the present time. They can be quickly erected and, better still, quickly taken apart and removed to another place out of the danger zone. Moreover, when the time comes to build a permanent home the little portable house will furnish the timber

Demountable houses of Sermaize erected on the ruins of the ancient city. They are warm and sufficiently commodious to be comfortable shelters for people whose earthly goods including household furnishings and even clothes have been destroyed in a terrible war

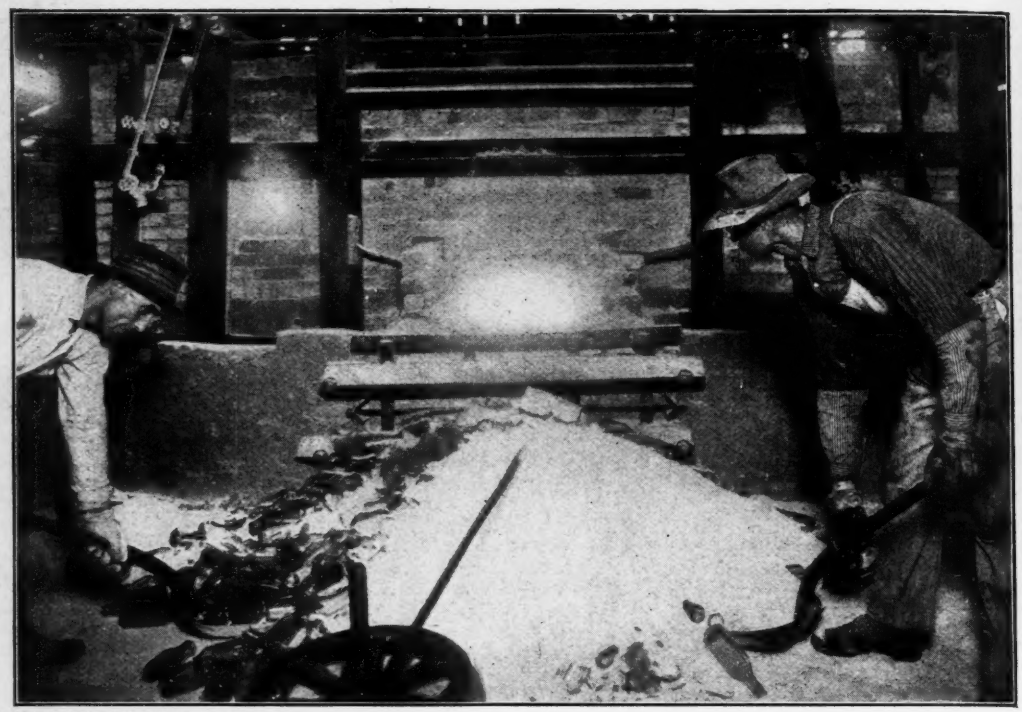
Hats Are Smaller, Say the Milliners

No, the lady above is not carrying the family washing on her head, and the lady below is not balancing a model of the Washington monument on her's. The hats are Gothic turbans worn by the members of the Russian Ballet in their royal frolic "Till Eulenspiegel." The two skyscraper hats are more than six feet high. What the white one lacks in height it makes up for in width

Utah's Famous Looking-Glass Rock

Looking-Glass Rock, so called because at a distance it reflects brightly the sun's rays, is one of Utah's great natural wonders. According to geologists' estimate, this rock was several thousand feet below its present altitude, seven million years ago. At that time it was nothing but loose, sea-level sand on which disported strange aquatic monsters and the great flying reptiles whose fossil remains have been found in great profusion in certain portions of the West. In later ages the continent was upheaved, the swamps drained away and dried up, and now Looking-Glass Rock is in the midst of a desert. Wind and blowing sand carved it into its present shape. Note the human figures in the opening

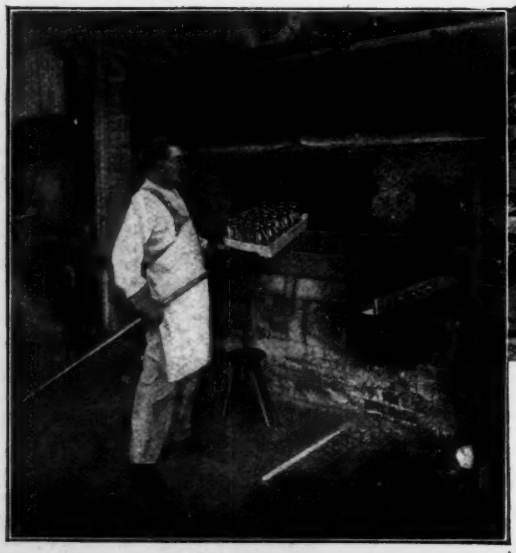
Bottles, Bottles Everywhere, But Not A



Photos Press Illus. Serv.

The basis of bottle glass is a siliceous sand, limestone and either sulphate or carbonate of soda. The photograph above shows the new mixture together with broken bottles being thrown into the furnace. Here it melts and forms a thick syrupy liquid which is later molded into the form of bottles

The photograph below shows another kind of raw material used for bottle-making—"cullet." It is a by-product of the glass furnaces and it is melted with the other raw materials. A combination of "cullet," sand, soda ash and lime gives a white glass with a very slight greenish tone



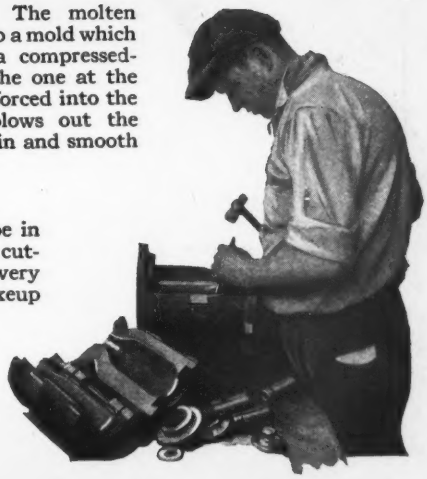
At left: Placing the bottles in an oven for gradual cooling. After they have been formed in the mold the bottles cool quickly on the outside while they remain at a high temperature within. To produce a clear, strong bottle a twelve-hour cooling is necessary

Drop to Drink Where They Are Made

Photos Press Illus. Serv.

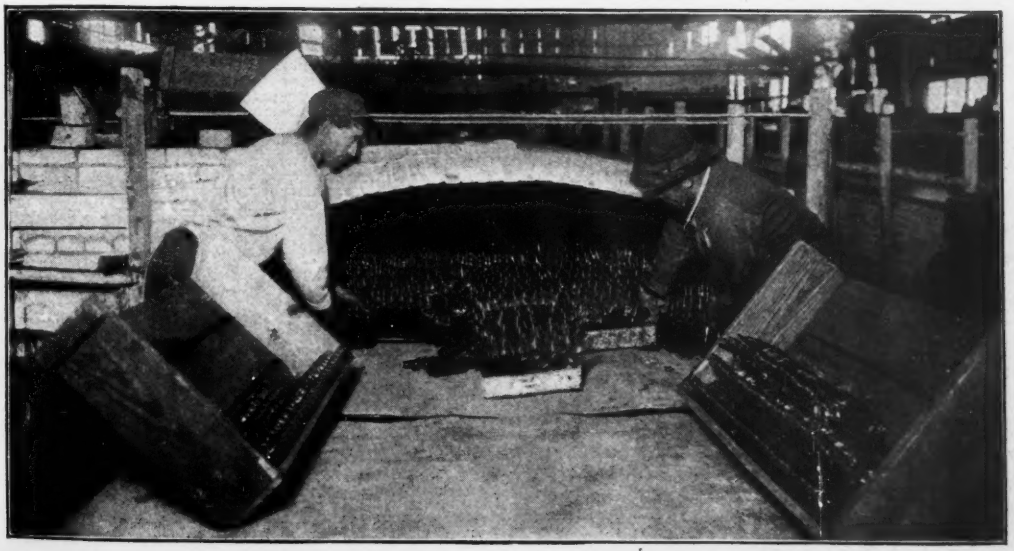
From the mold the bottles, still hot and soft, are transferred to a red hot table. The waiting boy grips the bottles with a special instrument and slides them into the annealing oven where they are very slowly cooled

At right above: The molten metal is poured into a mold which is swung under a compressed-air machine, like the one at the right. The air is forced into the mold where it blows out the glass, making it thin and smooth

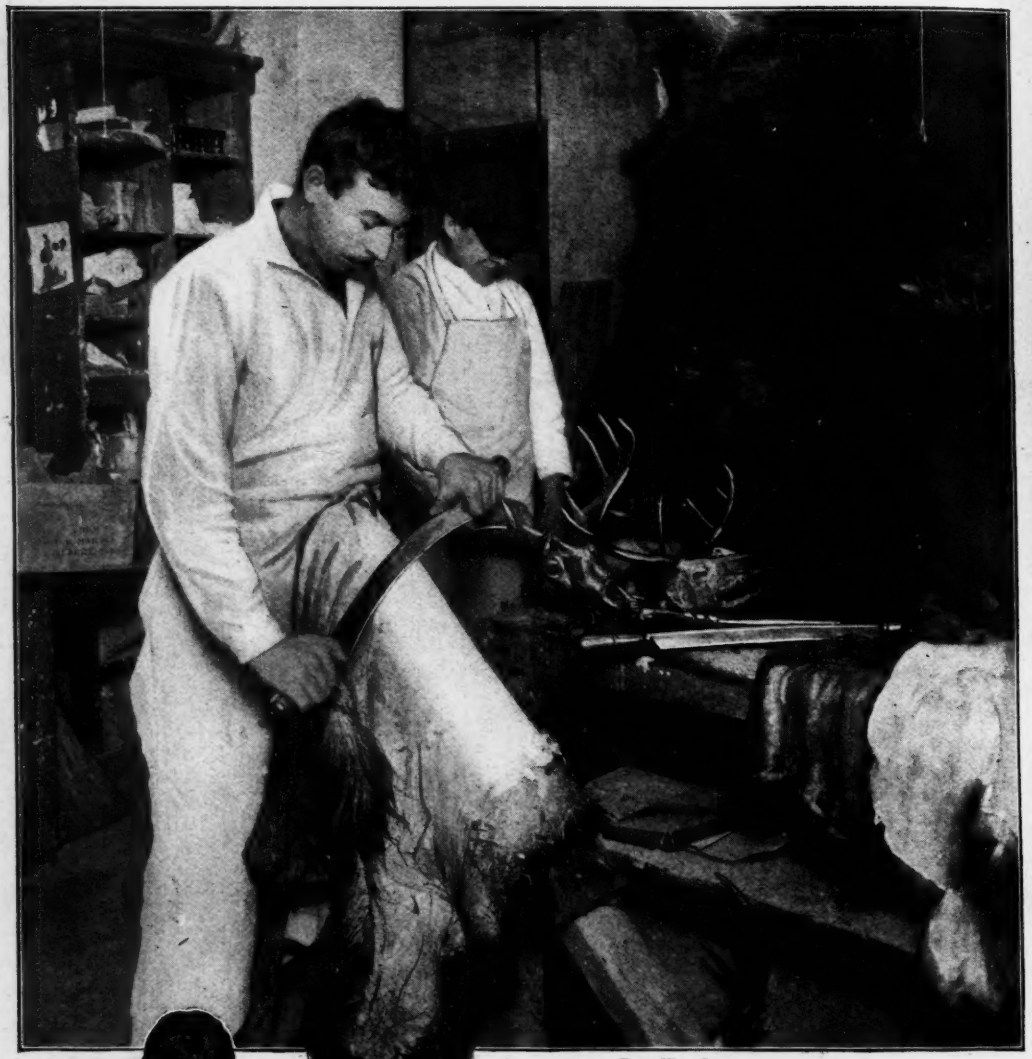


At right: While the bottle is getting its size and shape in the mold it is also getting its label. Here the man is cutting the monogram into the iron mold so that every finished bottle may have its label incorporated in its makeup

After twelve hours of gradual cooling in different compartments of constantly lower temperature, the trays of bottles are taken out and the bottles are transferred to cases, ready to be shipped or stored



The Taxidermist at Work



Photos Press Illus. Serv.

The taxidermist has some unpleasant work to do in the preparation of the animal for mounting. The bony structure of the head must be carefully cleaned out and scraped free from all particles of flesh. Then it is washed in carbolic acid. The skin also must be carefully scraped on the inside and "cured"

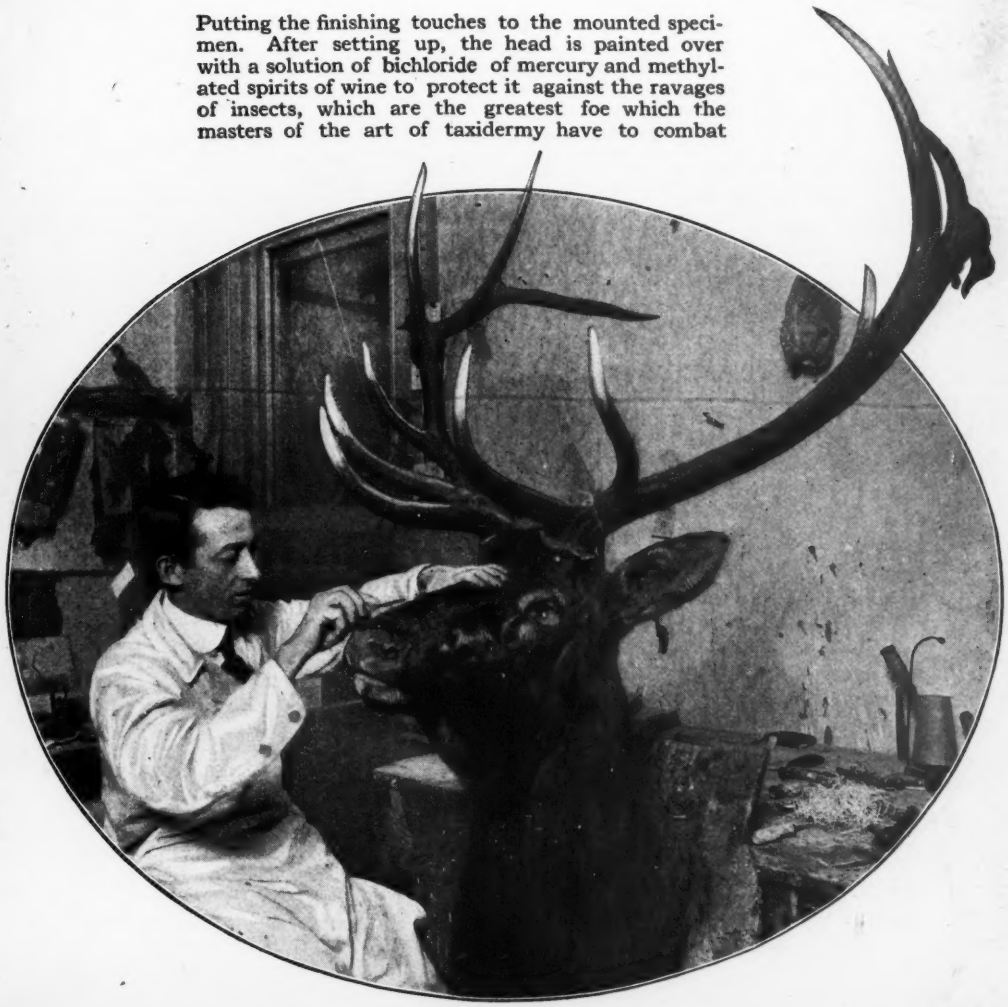
Scraping the skeleton. After this is done the taxidermist works over it with tow or clay to get the proper contour. When the worked-over skull has dried and set, the skin is drawn over it and finished off so carefully that, when the hunter receives his trophy, it seems just as it appeared in its native haunts

The Various Steps in Taxidermy

The greatest difficulty in mounting birds is to remove the skin without injuring the plumage. A bird is opened under the wing. After the body is removed the skin is painted inside with a preservative

Preparing to skin the deer's head. Sometimes a mold is prepared to take the place of the natural bones of the head. The skin is drawn over it and padded out with tow to correct any irregularities of contour

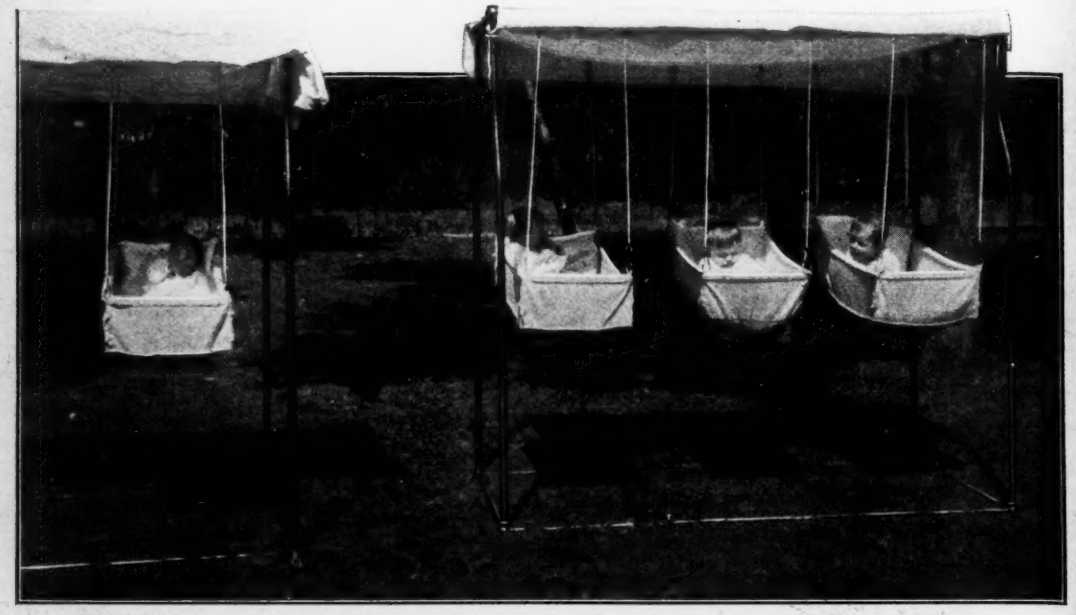
Putting the finishing touches to the mounted specimen. After setting up, the head is painted over with a solution of bichloride of mercury and methylated spirits of wine to protect it against the ravages of insects, which are the greatest foe which the masters of the art of taxidermy have to combat



The Lesson Denmark Taught with Calves

Have you heard of Dr. Bang? He freed Danish cattle of tuberculosis in a simple way, which New York City is now applying to poor, stricken children

By A. M. Jungmann



The babies at the Preventorium spend twenty-four hours in the open air. They are kept for about four months, during which time every effort is made to correct the home conditions

ONE of the most important steps ever taken in preventive medicine is directly attributable to the care Denmark lavishes on her cows. Dr. Bang, a Danish veterinary, whose task it was to conserve cattle which were threatened with extermination through the ravages of tuberculosis, discovered that calves of tubercular parentage are not necessarily tubercular themselves. His course was obvious. He simply took new-born calves away from their tuberculous mothers and fed them on sterilized milk from a bottle. They grew up into healthy cows quite free from tuberculosis. Since then Denmark has adopted the Bang method of fighting tuberculosis and freed her cattle from that dread disease.

How Children Are Saved by the New Plan

Dr. Alfred F. Hess is responsible for the application of Dr. Bang's method to New York's children. Until the Tuberculosis Preventorium for Children was opened at Farmingdale, New Jersey, we neglected to avail ourselves of the greatest weapon in the warfare against tuberculosis—that of saving the children from the disease.

Infants who become infected with tuberculosis when under one year of age rarely recover, and those who contract the disease between the ages of one and two years have a very poor outlook. Young children who are cared for by a consumptive mother or who are in daily or hourly contact with a consumptive father, can scarcely be expected to avoid infection. In conducting an investigation of one hundred and twenty homes wherein one or more of the adult members of the family were suffering from tuberculosis, Dr. Hess found forty-two infants under two years of age. Without exaggeration, that means forty-two infants doomed to succumb from tuberculosis. In many of the one hundred and twenty homes two or more infants were exposed to it.

Instead of adopting Bang's method, why not send away the tubercular member of the family? That is not always practicable. A mother cannot be spared from the household, for the very reason that she has an infant to care for as well as other chil-

dren. A father, though suffering from tuberculosis, is usually the bread-winner. Therefore, he can not be sent away.

It was to meet just such conditions that the Farmingdale Preventorium was built, to provide a place to accommodate young children in whose homes tuberculosis constituted a menace to their health. The institution was organized primarily with a view toward building up underfed, poorly-nourished children, who had been exposed to tuberculosis or who had contracted it, but who were in such early stages of the disease that it might be eradicated. Dr. Herman Biggs has estimated that there are forty thousand of these unfortunate children in New York City.

The Farmingdale Preventorium accommodates approximately two hundred children, who are kept there for an average of about four months, so that the institution provides for six hundred children in a year. It is situated in the sandy pine belt of New Jersey, where the air is particularly life-giving. The children have a fine playground of one hundred and seventy acres.

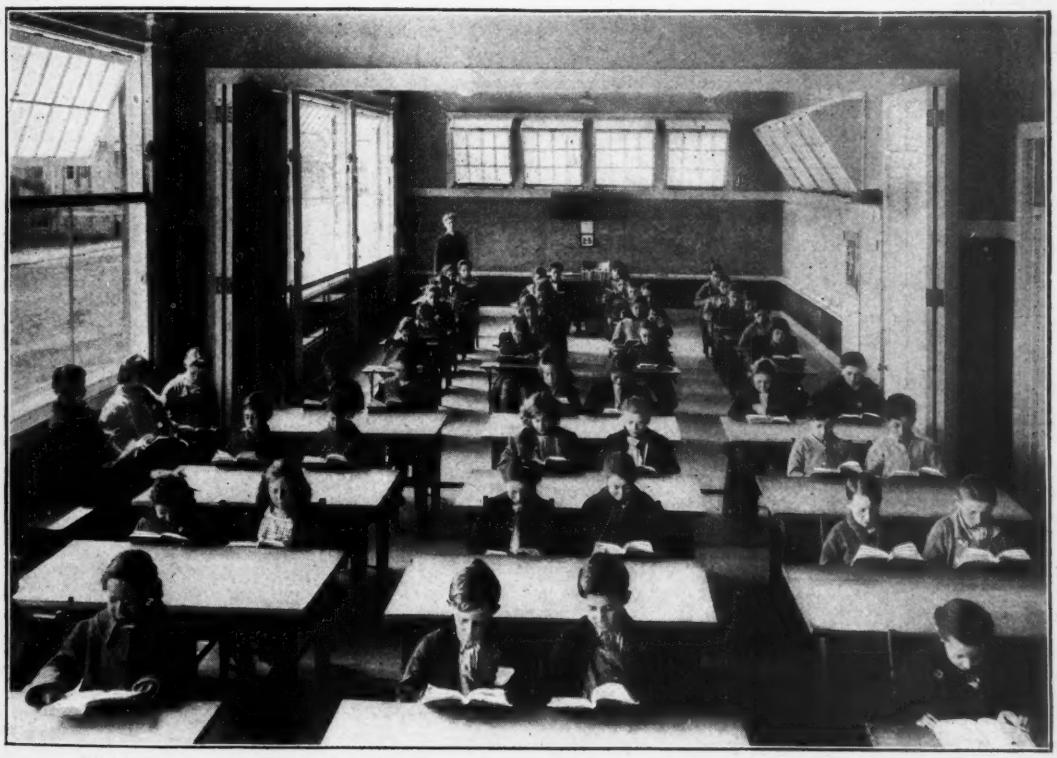
On entering the Preventorium each child is quarantined for three weeks in order to prevent infection of the other residents. Discharged from quarantine, he is assigned to one of the open-air shacks, each of which accommodates thirty-two children. Here he finds open-air sleeping quarters.

Next he goes to the open-air school and enters the class for which his city schooling has fitted him. For the first time in his life, perhaps, he is given good, wholesome food, and all he can eat of it. Twenty-four hours a day he spends in the open air, pleasant surroundings, room and sunshine in contrast to the crowded, dark tenement. No wonder he picks up. The average gain is about seven pounds, which represents fifteen per cent of the average body weight.

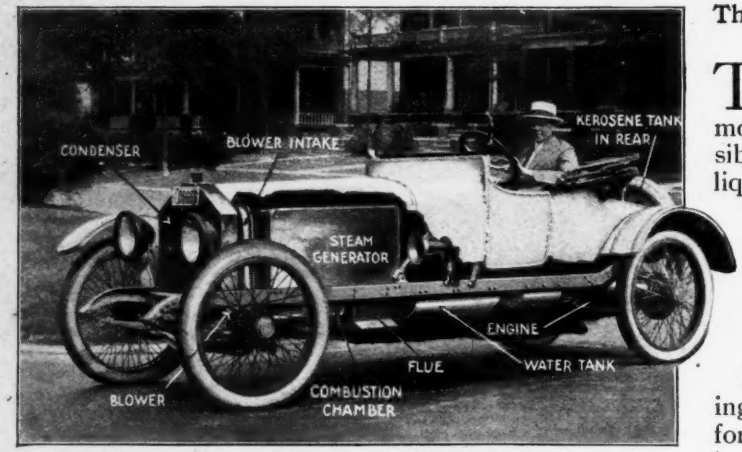
Teaching School in the Open Air

As children are accepted up to the age of fourteen years, school instruction has been provided for them that they may not be behind in their studies when they return to the city. Ten hours a week of school work keep them up to their grade.

While the children are at the Preventorium, every effort is made to improve the condition of their homes in order that their improvement may be permanent.



Children are accepted at the Preventorium up to fourteen years of age so that school instruction must be provided. Ten hours of school work a week are sufficient to keep the children up to their grade. The curriculum is the same as in the city schools



The steam engine is of the two-cylinder locomotive type with slide valves. It is controlled by a small switch and lever

Substituting Steam for Gasoline in Automobiles

GASOLINE is high. Next year its price may be even higher. Herein lie the possibilities of the new steam-driven automobile shown on this page. Like an ordinary gasoline car in appearance, the new steamer and its power plant eliminate the clutch and gearset, thus making for easy driving. The car is controlled by a small switch and throttle lever aside from the usual functions of steering and braking.

It is said that the car can run 1,400 miles without replenishing its water supply and that one gallon of lubricating oil will last for 8,000 miles.

Mechanically, the power plant of the car consists of a kerosene-fired boiler, a steam condenser and a two-cylinder double-acting steam engine. The water is pumped from a storage tank beneath the driver's seat to the boiler placed under the hood.

The water is then heated and turned into steam by means of a kerosene-burner below the boiler. The kerosene supply is piped from a tank at the rear of the car. It is ignited by means of an electric hot point controlled from the switch in the driver's cab. The air with which the burning kerosene must combine is automatically supplied in the proper ratio by means of an electrically-driven blower.

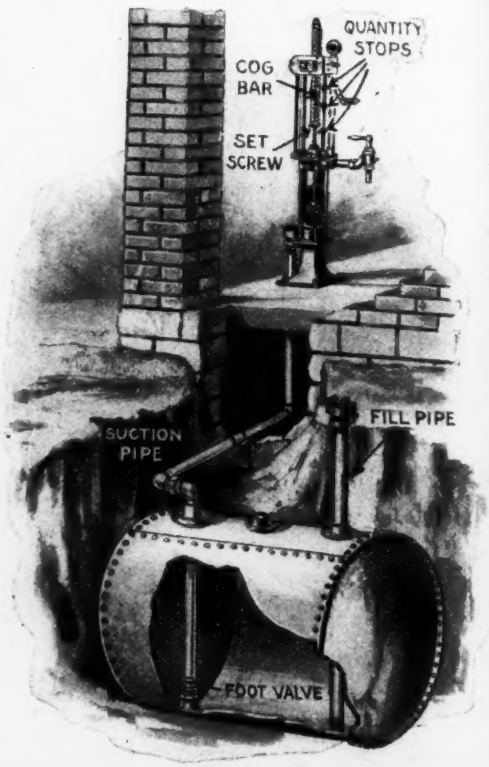
From the boiler the steam is carried aft to the steam engine which is mounted in a unit with the rear axle, driving the wheels direct. The exhausted steam is then carried back to the condenser, which takes the place of the ordinary gasoline car radiator. It is there turned back into heated water which is fed to the boiler.

The Popularity of Liquid-Measuring Pumps

THE great amount of gasoline consumed as a motor fuel has been responsible for the wide use of the liquid-measuring pump. In Greater New York alone there are seven thousand measuring pumps in use. There are thirty-nine firms engaged in making them at the present time.

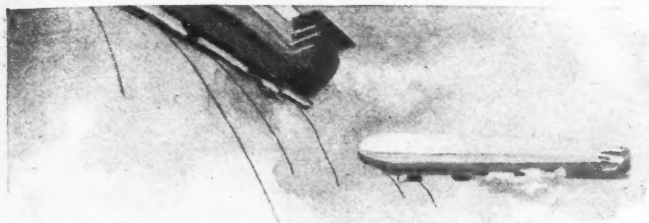
Briefly described, a measuring pump is a pump adapted for the measurement of fluids in definite quantities by volume. In many instances the pump itself is the measuring device, and in other types the pump is only used to fill a measuring chamber such as a pail or can.

The ordinary piston-pump discharges a volume of liquid equal to the space volume generated by the piston in its travel. The pumps may discharge only on the upstroke or on both the up and down strokes.



The pump delivers gasoline to the automobile with a minimum of waste and evaporation. It is usually a measuring device in itself

Dangling 'Twixt Earth and Sky from a Zeppelin



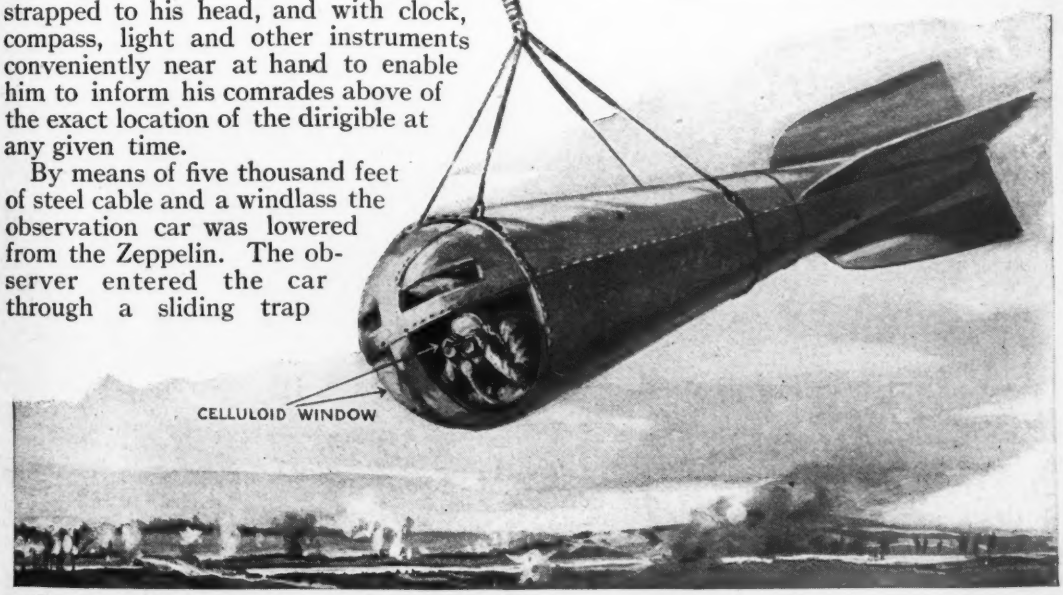
The real pilot of a Zeppelin is often a man suspended from the airship by a light steel cable nearly a mile long

ALMOST simultaneously with the first news of the part played by Zeppelin airships in the great war came rumors that the Germans were using suspended cages or baskets to act as observation or steering cars. Later, when a damaged Zeppelin cast off its observation car, windlass and cable, the rumors became undisputed facts and the military authorities ceased to wonder how the big ships of the air could maneuver with such unerring precision.

It was discovered that the real pilot was not the man behind the steering apparatus of the Zeppelin itself but a man lying prone on a mattress at the bottom of the observation car, with a telephone strapped to his head, and with clock, compass, light and other instruments conveniently near at hand to enable him to inform his comrades above of the exact location of the dirigible at any given time.

By means of five thousand feet of steel cable and a windlass the observation car was lowered from the Zeppelin. The observer entered the car through a sliding trap door in the top, and kept in constant communication with the men above. The telephone wire ran through the steel cable. The streamlike form of the car and its large fins at the rear enabled it to maintain a head-on course, making it possible for the observer to get a near view of the country below through celluloid windows, even though the Zeppelin was hidden in clouds and mists. On a stormy night it is thought that the observation car served as a great help in determining landing positions.

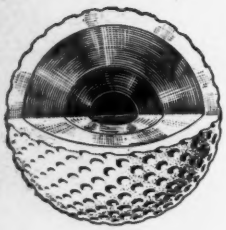
On the other hand, there are those who surmise that the man in the car dropped bombs. The main argument against this, however, is that the combined weight of the car and the bombs would prove too much of a strain for a light steel cable, if, indeed, it might not seriously interfere with the maneuvering of the Zeppelin. The duty intrusted to him is important and dangerous enough without the added responsibility of dropping bombs.



The streamlike form of the car and its large fins at the rear enable it to maintain a head-on course, and make it possible for the observer to get a near view of the country below through celluloid windows

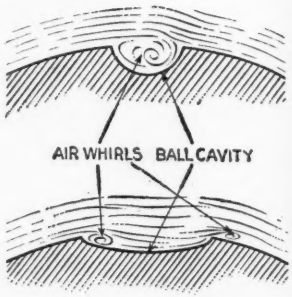
The "Why" of a Golf Ball's Flight

The corrugations on a golf ball are not meant to beautify the ball; they determine its maximum carrying distance



The secret of a golf ball's motion is to be found in the churning of the air by the corrugations on the surface. A blanket of air packs against it and diverts it

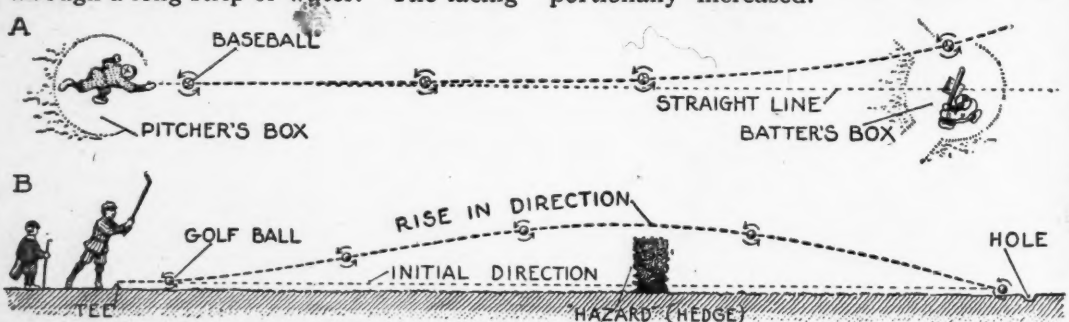
At right: A pitcher is able to "curve" the ball by making the ball churn the air. In a vacuum a body might be imagined to continue in a perfectly straight line



WE are told in school that when a ball is thrown into the air it generally travels in only one kind of vertical path, the so-called parabolic, while its path as seen from above never diverts from a straight line. But that this is not exactly true during baseball games and during golf contests, may be confirmed by any "fan." And when a long "brassie" drive is made, the golf ball may even rise upward during some part of its flight; so that its path can hardly be called parabolic. The schools would be exactly right in their statements if the effects of the air upon the spinning ball were not considered. But the fact is that if it were not for the influence of the air, a baseball could never be made to bewilder a batter nor a golf ball be made to "take" an obstructing "hazard."

When a pitcher desires the path of a baseball to curve in a certain direction, he gives the ball as it leaves his hand a rapid spin in this same horizontal direction. The effects of the air upon the whirling ball are exactly those that would occur on a more pronounced scale if the ball were thrown through a long strip of water. The lacing on the ball churns the air in which it spins and carries the air around with it. But the side which is turning in the same direction about the ball's center as the direction the ball itself is to turn, will be "packing" the air against its side, just as it would be doing with the water. Thus the air will be slightly compressed on that side, and as the ball skims along on the blanket of air so formed, it naturally will be pushed away from it and be made to curve in its path.

The corrugated marking on a golf ball causes exactly the same phenomenon to take place. Here, however, the ball is rotated around a horizontal axis instead of a vertical axis as in the previous case. The golf stick hits the ball on its under side so that this side rotates upward in front of the ball as it spins through the air. In this way the air packs the blanket this time underneath the ball, and so tends to divert the ball upward. As a consequence, the ball, instead of continuously being forced downward is also slightly pushed in an upward direction by the blanket of air underneath. The golf ball is thus able to stay up in the air longer and the length of its flight is proportionally increased.



A golf ball need not even travel in a parabola. By hitting it properly it can be made to rise up at a higher angle than that which it was initially given, and so lengthen its flight. The stick should hit the ball on its under side so that side will rotate upward in front of the ball

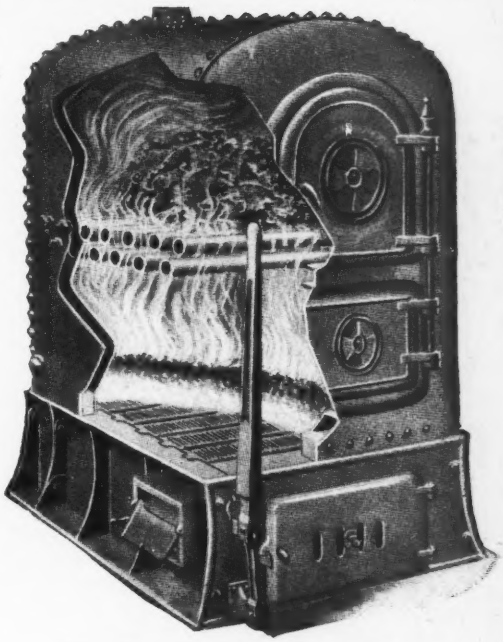
Combining the Telephone Receiver and Transmitter in One Instrument

A NOVEL method for combining the receiver and transmitter of a telephone into one instrument is the invention of an enterprising woman, Rosa D. Hatch, of Memphis, Tennessee. You speak and hear out of the same device. The receiver is mounted where the transmitter is generally placed on other telephones, while the transmitter is secured directly in front of the receiver.

The receiver also differs from the ordinary in that it contains a horn large enough to throw the sound forward a distance of about twelve inches. The transmitter is directly in front of the receiver but with its rear end towards it, so that there is little chance of the speaker's voice repeating into his own receiver. When starting a conversation, a button is pressed to connect the instruments with the telephone lines; and then, by talking and listening close up to the hood which encloses the instruments, the conversation may be carried on with privacy.

In this way the operation of the telephone is made much more convenient, although the essential construction of each instrument has not been changed. A telephone with such features ought to find special favor with business men.

Holding the receiver to your ears is unnecessary in this combination of telephone receiver and transmitter



The fire used to burn the garbage also heats the surrounding water pipes

A Water-Heating Garbage Burner Is Both Useful and Sanitary

A GARBAGE burner which also serves as a water-heater combines utility and sanitation. The garbage is placed in a chamber above the fire-box, the walls of which are the water pipes. This garbage burner is especially useful in the summer when fires must be kindled to heat water. The burner is provided with either a front damper-door or a base on which the damper-door is located at the side where the damper-chain is out of the way when the fuel is inserted.

The Origin of the Locomotive Whistle Is Associated with Butter and Eggs

ON a level crossing between Bagworth and Thorton in England, on May 4, 1833, there occurred an accident which gave us the locomotive whistle. Stephenson's locomotive "Samson" crashed into a cart containing fifty pounds of butter and eighty dozen eggs. Following the accident a meeting of the directors was called, at which Stephenson suggested that a whistle blown by steam be used to give warning of an approaching train.

© Brown & Dawson

This family windmill tree must present an amazing spectacle when performing to the accompaniment of a stiff breeze at the approach of a big storm

Thirteen Windmills Decorating One Pole

ONE windmill to a pole is considered a sufficiency, as a rule, but a Connecticut boy has decorated a pole in his back yard with thirteen of them. Some of his designs are unique. For instance, there is the ocean liner with the windmill on the "port side and another serving as the propeller. There is an aeroplane windmill among the number and an assortment of human figures, including an original Indian that beggars description. The figure topping the pole looks to be a half-cousin to those little fellows that adorn automobiles. The owner must be well-informed as to wind indications.

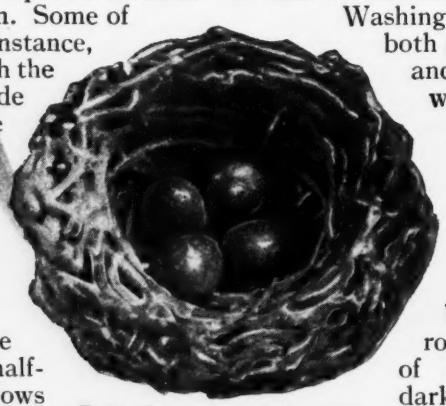
Music From the Bowels of the Earth? Yes; in Texas

THE south central portions of the United States abound in natural curiosities. Not only are there strange things to see, but mysterious sounds often cause the most unimpressionable and hardened traveler to avoid passing through certain localities alone, and especially after dark. Reverberations of the wind are the cause; but the mountaineers will tell you that the thundering footsteps of "Morgan—Morgan the raider, and Morgan's terrible men" may still be heard in calmest weather in certain localities which they laid waste decades ago.

A less eerie, but similar phenomenon of sound is heard in Texas, where there is what is known as the "singing well." In fine weather dulcet tones like the music from an Aeolian harp issue from the well. At times the sound is wonderfully clear and loud. Then it recedes, until it reaches the ear only faintly. These modulations occur regularly every few minutes. When an east wind blows, the water in the well is low and the musical sounds are faint; but a strong west wind will increase the volume of sound to a chorus. It is when the north wind blows, however, that the music of the well is most weird and wild.

A Wonderful Specimen of a Petrified Bird's Nest

PETRIFIED bird's eggs have been found on several occasions, but as far as can be ascertained, it remained for a Washington State man to find both a group of petrified eggs and the petrified nest in which the eggs were originally laid. The nest was imbedded in a rock formation in a cliff of the Grand Canyon, five hundred feet above the base. It must have been the nest of some bird about the size of a robin, and only one side of it—what is now the darker side—must have been exposed to the air. It is impossible to estimate how long ago the eggs were laid.

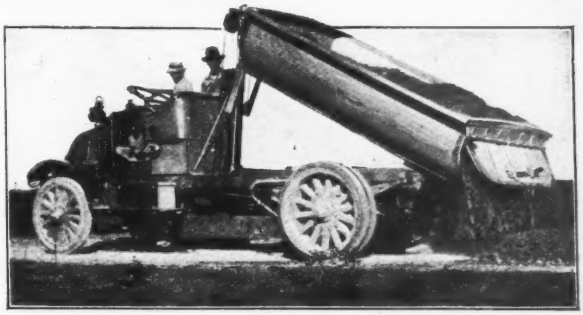


Both the nest and the eggs are now solid rock. The original owner was a bird probably about the size of a robin

How Much Ought We to Weigh Normally?

A SIMPLE way to ascertain one's ideal weight was told recently by Dr. Harvey G. Beck, of the University of Maryland, in an address before the Los Angeles County Medical Association at Los Angeles, Cal.

First, put down 110. Then multiply by 5½ the number of inches by which one's height exceeds five feet. Add the result of the multiplication to the original 110 and the sum is one's "ideal weight."

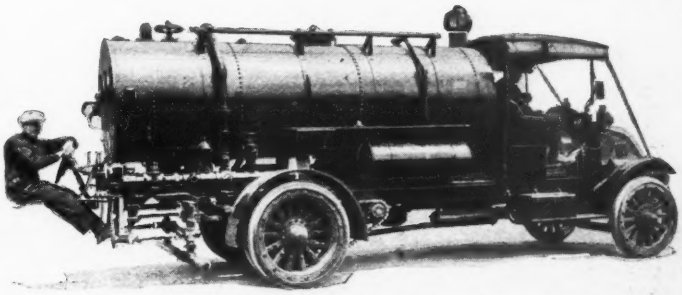


When the road-oiling season is over the tank and its fittings may be supplanted by another type of body

Concrete Drinking Fountain of Novel Design

THE drinking fountain shown in the illustration has several features that serve to make it distinctive. It is constructed of concrete and boulders, rough concrete blocks, and similar material.

On the side toward the house there is a drinking fountain for the passer-by; the waste water drains from this into the side toward the street where there is a drinking-trough for horses. In this way the problem of the waste from the drinking-fountain is solved.



The oil is heated in the tank and forced out onto the road under pressure through specially prepared nozzles

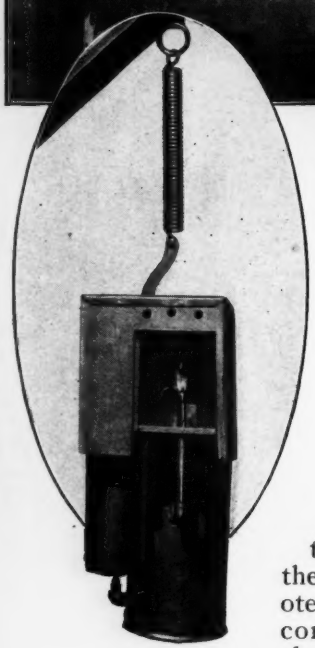
Demountable Road-Oiling Tank Saves Truck's Winter Time

NOT long ago it was considered the up-to-date and progressive thing to own a motor truck for each kind of special service for which such a truck could be employed. But now the most progressive idea is the truck which can be used in more ways than one, thus reducing the cost and increasing its efficiency. This is usually accomplished by providing two or more bodies to be used interchangeably on one chassis.

The road-oiling tank and mechanism shown in the accompanying view is mounted on a separate sub-frame, so that it can be removed as a unit from the motor truck in less than half an hour. Ten holding-down bolts are removed, and the entire apparatus is lifted off the chassis by an overhead crane. This overcomes the great drawback of mounting equipment of this kind on motor trucks. When the road-oiling season is over the tank and its fittings may be removed and another type of body fitted in its place. Hence the truck becomes a money-maker all the year round. Formerly it was a dead loss in winter because the tank was fixed. The tank shown heats the oil and then forces it on the road under pressure through special nozzles.

A picturesque effect secured with ordinary stones set in concrete in a street fountain

Protecting Flocks from Coyotes by Means of a Gas Lamp "Gun"



Coyotes are afraid of light and flee at the sound of a gun. This gas lamp causes an explosion at regular intervals which is similar to a pistol shot. At the same time the lamp revolves constantly, shedding light in every direction

A NOVEL gas lamp known as a "coyote" gun is being used extensively by western ranchmen to protect their flocks from the ravages of coyotes. The device consists of three chambers and a lamp box. In the upper chamber is water which drips into the larger chamber below, filled with calcium carbide. The greater part of the gas feeds through a tube to the blaze but a quantity is forced into the third chamber, on the left side, and from there at about one minute intervals it feeds through to the lamp box and causes an explosion similar to a pistol shot. The device is attached to a spring and suspended four or five feet above the ground. The explosions keep the "gun" revolving and throwing the light in every direction.

Coyotes are afraid of a light and flee at the sound of a gun. In the past it has been the custom of the sheepmen to keep herders on duty all night, firing a gun every few minutes, and keeping a big campfire burning brightly.

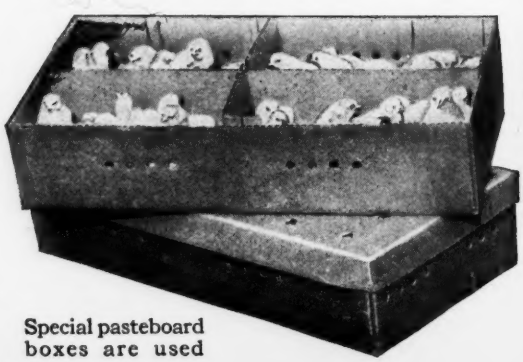
The "gun" does away with this. It will operate for a period of about fourteen hours without refilling.

Shipping Day-Old Chicks Is Profitable at Both Ends

WHEN little chicks come from the shell, they need neither water nor food for sixty hours. That fact has given rise to a new business. Day-old chicks are sold and shipped by people who operate incubators. Those who buy are relieved of the trouble, of the inconvenience and to some extent of the uncertainty of hatching. Only a small percentage of day-old chicks perish while on the way from shipper to customer. People are thus enabled to get the little chicks and begin the poultry business without the necessity of purchasing an incubator.

Special boxes of pasteboard, are made for shipping purposes. Some have a capacity of twenty-five chicks, some of fifty and some of one hundred. It is doubtless best that no more than twenty-five shall in any case occupy a single compartment. The walls of the boxes are moderately thick, and some soft material as grass is put in the bottom. Otherwise there are no especial provisions against cold weather. However, the chicks themselves may be depended upon to cluster together and in this way keep one another warm.

The boxes are not to be opened *en route*, nor are the chicks to be given food or water. Successful shipments have been made for two thousand miles.

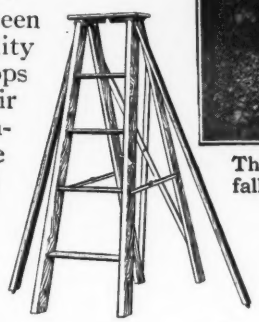


Special pasteboard boxes are used

This River Is One of Nature's "Find It If You Can" Puzzles

"TO him who in the love of Nature holds communion with her visible forms," she often appears as a most incorrigible tease. She loves to clothe herself in mystery and propound enigmas and puzzles. The Hidden River, in Kentucky, so called because its source is unknown and its outlet undiscoverable, is one of her imagination-exciters. It comes to light for a short distance only, runs turbidly along without ripples or tides over its pale blue waters and vanishes into a cave leading no one knows where.

Digging War Trenches with a Powerful Tractor



THE present war has been fought with such rapidity that in many instances troops have not had time to dig their trenches and barricade themselves before the enemy made fresh attacks. The demand appeared long ago for a trench-digging tractor, but such a machine did not appear on the European battlefields until recently, when the tractor illustrated was put to work in France.

It digs a trench as it goes along, just as the common farm tractor plows furrows as it goes along. The earth thrown up on one side serves as the breastworks. The trench-digging tractor is built on a larger scale than any seen in this country. It is said to be doing excellent work for the French.

The extra leg on the ladder prevents it from falling over or slipping, and keeps it steady

A Ladder Which Can't Slip or Fall Over

A LADDER which can be used with equal facility on a side-hill or in the home has been invented by B. B. Keith of Mansfield, Ohio. It has two additional legs or props, one at each side. This prevents the ladder from slipping, and increases its strength. When the ladder is on a level surface both extra legs are used, but when it is used on a hill or on uneven ground only the leg on the down-hill side is necessary as the prop.

The powerful tractor which digs trenches just as an ordinary farm tractor plows a furrow. The earth that is thrown up serves as breastworks. It is in use by the French. Soldiers are operating the machine

The Road-Rail and Its New Truck

How it will save our highways

A section of the economical roadway. It is of smooth Portland cement with a single rail embedded in the center and flush with the road surface. About ninety per cent of the weight of heavy trucks is carried on this rail

A LARGE part of the cost of maintaining improved roads is due to heavy motor traffic. Motor trucks and motor omnibuses carrying loads of five to ten tons at speeds reaching fifteen to twenty miles per hour now run over roads improved at large expense, and cause great damage. State highway authorities all over the country recognize this as a most serious threat to the permanence of their highways.

To meet the situation, in part at least, Mr. Charles Whiting Baker, a well-known New York engineer, has designed a transportation system which carries its load on a smooth steel rail and which furnishes at the same time a permanent and durable automobile highway at low cost.

The roadway consists of smooth Portland cement concrete. In the center of the roadway there is embedded a single line of steel rail, the head of the rail flush with the surface of the road, so that it does not interfere at all with the use of the road by automobiles or horse-drawn vehicles.

The cars which run on this rail have double-flanged wheels running on the rail and they are kept balanced over the rail by ordinary vehicle wheels which run on the concrete roadway on either side. The cars are built with a low floor, only a few inches above the road surface, and the weight of the car and its load is thus brought down so low that the load on the balancing wheels to keep the car steady is very small. Not more than ten per cent of the car's weight is carried on the balancing wheels, so that even if the car with its load weighed as much as fifteen tons, the weight carried by the balancing wheels would be no greater than that carried by the wheels of an ordinary light touring automobile.

To propel the car there is at one end a gasoline engine, about the size of that used on an ordinary touring car, direct connected to an electric generator. On the trucks of the car are electric motors, which, by a sprocket-chain transmission, drive the car wheels on the rail. Suitable controllers distribute the current generated on the car to the motors on the trucks. The whole equipment is, in fact, similar to (but of smaller size than) that used on railway gasoline-electric cars, a large number of which are in successful operation in various sections of the country.

As the car is very light compared with an ordinary railway car and is designed for low speed operation, the power required to drive it is small. The cost of building this kind of a roadway may be varied within wide limits according to the character and volume of the traffic carried. A concrete road suffers practically no wear from the traffic of pneumatic-tired vehicles. What causes the wear is the grinding action of steel tires of heavy wagons. The monorail in the concrete roadway is designed to relieve the road of the burden of such trucks and thus lengthen the life of the highway and reduce the cost of its maintenance.

"Don'ts"
for Gasoline Users

Don't use gasoline near a machine

In a single year in the United States 1,040 persons were burned to death and 3,120 persons injured (a weekly average of 20 persons killed and 60 persons injured) on account of gasoline fires. From the transportation of gasoline alone there recently resulted a yearly damage amounting to nearly $118,000. Nearly all such disasters and losses are due to carelessness

Don't wash the hands with gasoline

Don't smoke cigarettes while cleaning clothes with gasoline.

If you are cleaning silk with gasoline, don't rub it hard. Violent rubbing of silk generates electric sparks that will set fire to the gasoline.

Don't clean automobile parts with gasoline in an open can. Two pieces of metal striking together will cause a spark.

Don't smoke cigarettes while filling your fuel-tank.

Don't use liquid-fuel lamps with glass oil-wells if you can get metal ones.

Don't use gasoline in a room where there is an open light or flame of any kind.

Don't pour out more gasoline than you intend to use.

Don't use gasoline in a room where there is a machine which may cause a spark.

Don't spill gasoline.

Don't use gasoline to wash your hands.

Don't use gasoline where there is machinery with belts. Electric sparks are produced by the belts.

Don't use gasoline in a room where there is machinery with shafting.

Don't use gasoline in a room where there are electric switches or fuses.

Don't use gasoline in artificial light if you can help it. But if you must, see that the lights are electric and that the bulbs are provided with guards to prevent them from being smashed.

Don't use gasoline in an open pan without a cover. Keep the cover handy and cover the pan when you are not actually using it.

Don't fill the tank of your liquid-fuel stove full.

Don't use a leaky liquid-fuel stove.

Don't fill a gasoline stove in a room unless the windows are open. You need plenty of air to carry the vapor out of the room.

Don't clean automobile parts with gasoline in an open can

Don't use gasoline in a room where there is an open light

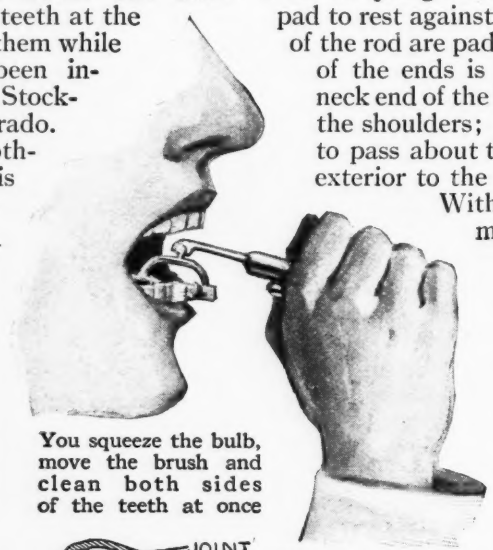
Don't smoke cigarettes while cleaning clothes with gasoline

Don't rub silk hard when you are cleaning it with gasoline

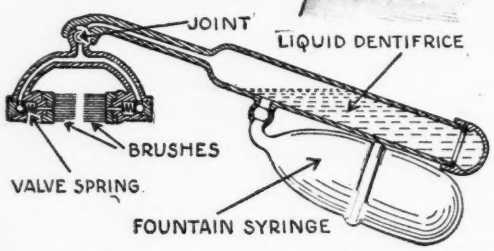
A Fountain Brush Which Cleans Both Sides of the Teeth

A NEW toothbrush which can clean both sides of the teeth at the same time—and wash them while cleaning them—has been invented by Lincoln C. Stockton, of Denver, Colorado. The handle of the toothbrush is hollow and is connected with a bulb filled with water or any cleansing liquid from which the liquid may be discharged into the hollow handle and into the head of the brush, which is provided with ducts to carry the liquid to the brushes.

The brush is operated in the same manner as the ordinary toothbrush. There are, of course, two brushes—one to clean the outside of the teeth and the other to clean the inside of the teeth. As the brush is moved back and forth the bulb is pressed from time to time, forcing the water or cleansing liquid to the teeth.



You squeeze the bulb, move the brush and clean both sides of the teeth at once



A Spinal-Column Harness for the Back-Bending Workman

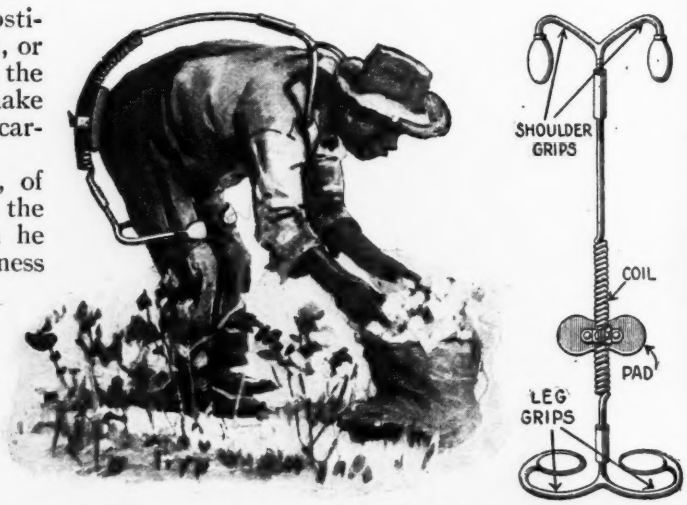
THE man who invents a substitute for the spinal-column, or some sort of contrivance to take the pain out of back bending, will make enough money to buy his wife a carload of diamond tiaras.

Evidently Robert E. Kelly, of Cocoanut Grove, Florida, had the diamond tiaras in sight when he invented his spinal-column harness illustrated on this page. Its purpose is to prevent fatigue of the back muscles—so he says. But does it? Hasn't he overlooked the fact that the wearer must perform work in storing up energy in the spring and that he must constantly fight the spring's tendency to bring him into an upright position?

The invention consists of an elongated bar which, between its ends, is twisted into a coiled spring on which there is mounted a pad to rest against the body. At each end of the rod are padded grip-members. One of the ends is shaped to straddle the neck end of the body and to extend over the shoulders; the other end is shaped to pass about the legs of the operator, exterior to the thigh portions.

With the aid of its grip-members the brace is able to remain in position on the body of the operator, even when he is standing upright. When the workman assumes a stooping position the weight of the body is in a large measure sustained by the elastic tendency of the brace to assume the straightened-out position.

Perhaps the inventor's idea may be to help the workman to raise up again after he has been bending for some time. We can imagine that he might find some difficulty along that line. However, "The proof of the pudding is in the eating," and the only way to find out the good qualities of Mr. Kelly's back brace is to try it out.



Uncle Tom may think he is beating the forces of nature but he isn't! Every time he bends over he has to perform a certain amount of extra work in storing up energy in the spring

Mr. Average Healthy Man's Enormous Appetite

AN average man who has seen seventy-five years of life has eaten an amount of food equal to some fifteen hundred times his own weight. One hundred and ten tons of food he has consumed, of which the bread alone, if it could be piled separately, would occupy a space equal to that of a good-sized building. The vegetables on reappearing would fill a train three miles in length and the bacon when placed end to end in single slices would stretch along a line four miles long. The reappearance of five tons of fish and one-fifth of a ton of cheese would surely haunt him, while twelve thousand eggs, ten thousand pounds of sugar and fifteen hundred pounds of salt would put in their claim. And he has smoked no less than 250,000 cigarettes. Let's hope he has saved the coupons.

The Sandwich Man As an Ally of the Telephone Companies

WHEN a disastrous fire swept through Paris, Texas, not long ago, utterly destroying more than fourteen hundred homes and many business houses of the city, the telephone system was badly crippled. Not only were private lines destroyed, but on account of the scattering of families into temporary quarters all over the city it was almost impossible to locate any one called over the long distance wires. An exchange was connected temporarily to handle such calls, but the problem was to find the person wanted.

It was finally solved by employing the sandwich-man idea. Several boys were engaged to carry blackboards sandwich fashion, on which were written in large letters the names of the persons wanted. Primitive as was the plan (dating back to 1780, to the fourth Earl of Sandwich, who originated the idea) it cleared up the situation until the telephone lines were restored. The sandwich boys were not of the usual silent type but whistled and called to every passerby to read the sign.

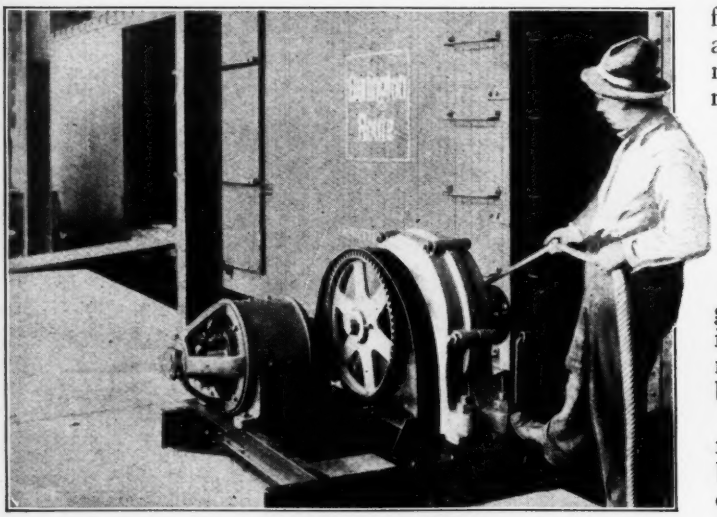
The expedient to which the telephone companies of Paris, Texas, were forced to resort

The detachable motor drives the bicycle at a speed of thirty miles an hour

Convert Your Bicycle into a Motorcycle with This Detachable Motor

A NEW bicycle motor, so small that it reaches only from the top of the front wheel to the handlebars, is to be placed on the market for those who wish to convert their bicycles into motorcycles. The motor, a complete gasoline engine in miniature, has a flywheel and a muffler. It is clamped to the wheel by a strong side-fork, so that a steel traction-pulley presses down upon the tire at its center.

The gasoline-tank on one side is balanced by the weight of the flywheel on the other, so that the pulley-groove is pressed down uniformly across the tire. The ignition system consists of a small spark-coil and two dry cells, which are stored in a small case suspended from the horizontal bar of the bicycle frame.



The car-puller is located beside the track and is belted to a motor or to a line-shaft through a clutch-pulley

Car-Pullers Take the Place of Switch Engines

SHIFTING railroad freight cars at industrial plants by hand labor is both expensive and slow. With a switch engine it is still more expensive. These are two reasons why car-pullers are coming more and more into use. The car-puller consists of an electric motor which drives a cable drum, winch-head or capstan around which a rope or steel cable attached to one freight car or a string of cars is fastened. When the drum revolves the rope tightens and the cars are slowly pulled toward the machine.

In one plant a twenty horsepower motor was strong enough to handle ten loaded freight cars on a slight down grade and to shift from six to ten loaded cars daily. The maximum length of haul is about three hundred feet. The car-puller shown in the accompanying illustration is capable of hauling from three to five loaded cars. It is small and very compact.

Is Ink Becoming Scarce? Not in Algeria

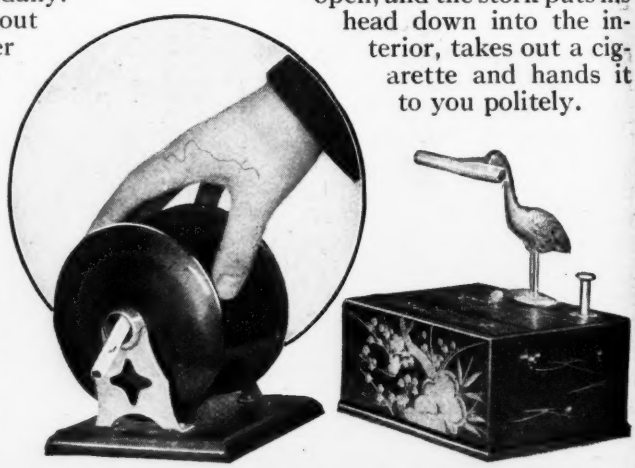
WITH the price of ink soaring to keep pace with paper, and the cuttle-fish seemingly on strike, the manufacturers of writing fluids will probably be glad to have their attention called to a river of the purest kind of ink waiting to fill the demand from a seemingly inexhaustible source. It is of the favored blue-black variety and is guaranteed by Nature not to fade. To be sure, it is rather a long way off, being located in Algeria, but that is not much of a consideration.

The ink river is formed by the union of two streams, the water from one of which is impregnated with gallic acid and the other with iron. These are the two necessary elements of the best ink.

The earliest ink of the man-made variety was prepared by suspending a bag of soot or other carbonaceous material in some sticky solution such as glue or varnish. Later the cuttlefish was found to yield a secretion which could be used for the purpose. But the modern blue-black ink is obtained from gallic acid, usually from China or Turkey galls, mixed with iron sulphate. This is the kind with which the Algerians might flood the market.

Mahogany Cigarette Mills That Pass the Cigarettes

A STRIKING and convenient accessory for the smoking room is a cigarette mill. One type is turned by the hand as shown in the illustration; at each revolution it turns out a cigarette from the "hopper." In the stork type the user pushes the button; this causes a panel to open, and the stork puts his head down into the interior, takes out a cigarette and hands it to you politely.



To get a cigarette you turn the mill at the left or press the button at the side of the stork

Next Summer's Ice. They are Cutting It Now with Electricity

ONLY six years ago this winter ice was cut by driving a horse over a slippery field. The horse dragged a sharp-edged ice-plow which dug deeply into the ice and finally cut it into pieces as small as was possible by such a method. How differently is this done now. A single electrically-driven, rapidly rotating blade like a buzz-saw drives itself across the field, cutting it into large oblong pieces as it is guided and pushed by the man behind. After this, the pieces are floated into a large saw-mill where they are rapidly cut into small cakes.

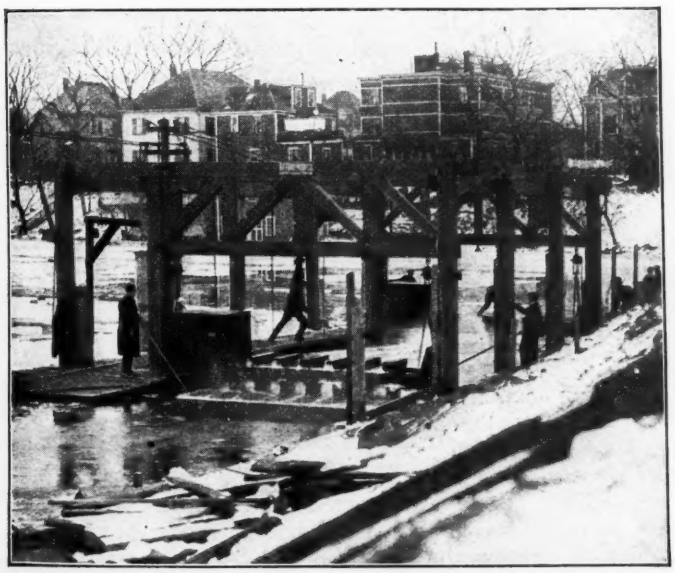
The mill contains two separate batteries of saws, all electrically driven. The first battery consists of three saws at the front of the mill which are evenly spaced apart. Some distance behind, the second battery, consisting of seven saws, is placed. As the floats of ice reach the mill they are pushed against the first battery of saws and pulled along by them as they are cut into four pieces. Next, the strips are turned around through an angle of ninety degrees and fed into the second battery. Here they receive their final cut and come out as cakes, generally square or oblong in shape. These cakes are then floated downstream to the warehouse where they are stored until delivery.

Floats of ice forty feet wide by fifty-five feet long can be cut in a minute into small pieces.

The toothbrush fits snugly in a hollow chamber in the back of the comb from which it can not easily slip out

A Combination Comb and Toothbrush Holder

PERHAPS the most novel combination in this day of two-in-one devices is the one illustrated in the accompanying photograph. It is a small comb, of vest-pocket size, with a hollow chamber in the back, into which a toothbrush may be slipped for safe keeping. The upper and lower walls of the hollow chamber are thickened at one end to provide a restricted neck and flared mouth, to conform to the contour of the brush-handle.



The mill through which the ice is floated to be cut into cakes before passing downstream to the warehouse for storage

France Completes the World's Largest Tunnel

A FEW months ago, France counterparted her remarkable engineering feats along the breastworks of Verdun with an equally great achievement through the peaceful hills of Rove. A tunnel seventy-two feet wide, fifty-two feet high and four and one-half miles long—larger than any other in the world—was completed. This spacious tunnel, the result of twelve years' planning and labor, is part of a great canal system which will, in the near future, connect the network of the canals of France with the Mediterranean Sea. The system will be fifty one miles long.

The weight of the bag tightens the fit of the strap around the wrist so that the bag cannot slip off

It Is Almost Impossible for You to Lose This Hand-Bag

A NEW YORK man has invented a simple device which should be a boon to careless women, as it prevents the loss of the hand-bag. The leather handle is fitted with two metal slides on one end of which is a roller. These slides are fitted to the handle straps and are connected by a short piece of leather of the same width as the handle.

When the handle is slipped over the arm, the metal slides are pulled up by the weight of the bag so that the handle fits close around the wrist and makes it impossible for the handle to slide over the hand.

This is only one of many devices which have been invented and placed on the market recently for the purpose of helping women to hold on to their purses, which are so easily lost in crowds.

The average man is doubtless more interested in probable means of persuading them (at least those of his own immediate family) to keep possession of the contents of the purses a little longer.

Consider the Cow. She Helps Make Buttons and Shoe Polish

WITH no apparent effort the cow goes through her span of years yielding her full quota of milk and looking always as if she could impart great secrets to the world if she had the gift of speech. She is an industrial asset, not a mere purveyor of baby food. It has been proven that casein, which forms over three per cent of the total weight of cow's milk, is an important commercial product and may be profitably employed in the manufacture of glue, combs, buttons, linoleum, hair-pins, toys, paints and even shoe polish.

In the preparation of casein for commercial purposes, about seven hundred gallons of skimmed milk are put into a great vat and heated to about one hundred and thirty-five degrees, Fahrenheit. Then very dilute sulphuric acid is added to precipitate the casein or curd. The whey is drawn off and the curd is drained and cut into chunks, after which streams of cold water are played on it to wash out the acid. The curd is then dried with rotary fans and ground into powder, in which form it is placed on the market. One hundred pounds of skimmed milk will yield about three and one-half pounds of casein powder.

Saved by the Bullet Intended to Kill Him

IT is better to be born lucky than rich, they say, and no doubt a certain policeman of Alton, Ill., will sanction the sentiment. He was one of a squad sent recently to arrest two desperate criminals who had been located hiding in a boarding house. When cornered, one of the men at bay pressed the muzzle of his revolver against the policeman's abdomen and pulled the trigger twice in rapid succession.

The first bullet which was fired rammed in the barrel, effectually blocking the path of the second bullet

The first bullet rammed in the barrel about an inch from the cylinder. This effectively barred the pathway of the second shot, the force of which tore a strip from the barrel an inch long through which the bullet escaped, thus destroying the usefulness of the weapon.

Keeping Track of Piece Work

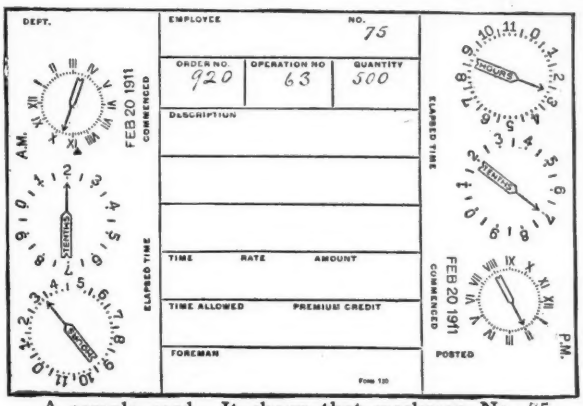
An automatic timekeeper calculates the time each workman spends on a job, and needs no verifying

AN ingenious machine has been invented which automatically calculates the time spent by any workman on any job. The machine prints this time on a card in addition to the times of starting and stopping.

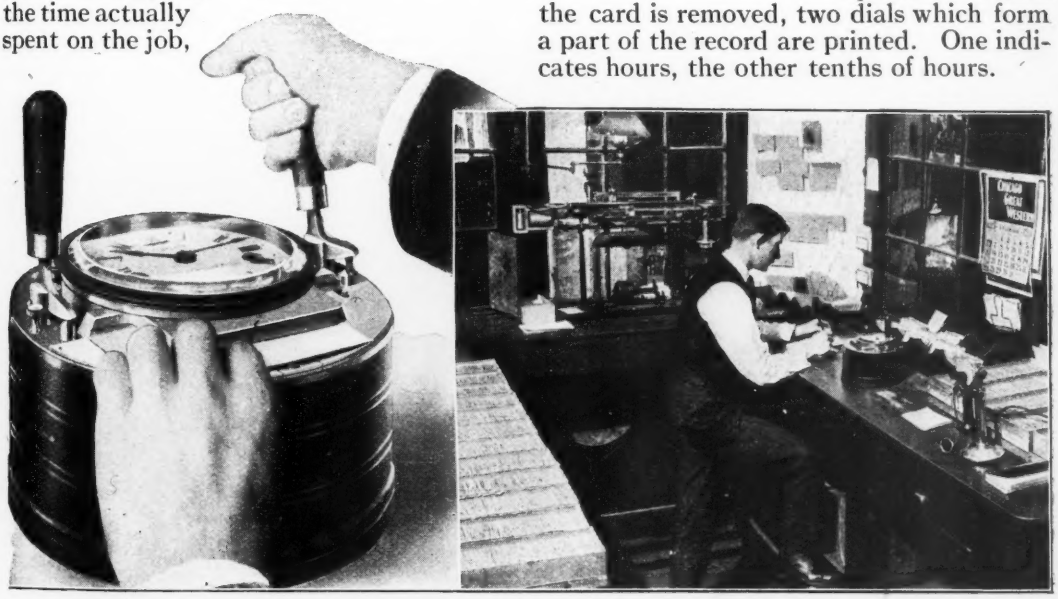
Each workman uses a card for each job. He stamps it at the machine when he starts and again when he finishes. Each card shows the starting and stopping time of each job and the elapsed time spent on it. Hence the cards can be used in determining many vital factors in the cost of modern factory production including the labor cost of the product; the productive and non-productive hours; the machine time, and the time actually spent on the job, to determine the payroll efficiency records and data for piece work prices.

The machine itself consists of a small cylindrical barrel about eight inches in diameter and six inches high. It has a clock on its upper face with two handles, one on either side. These are used for printing the various times on the cards.

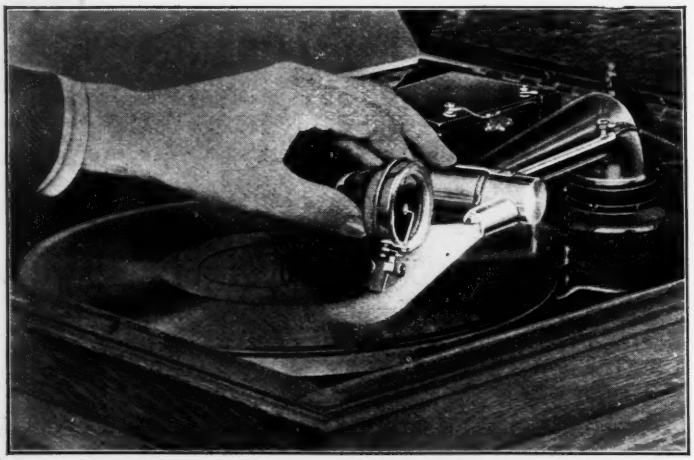
In operation, the card is first inserted in a slot on top of the machine and the right-hand lever is pushed away from the operator. This prints the date and the time of day, a printed arrow indicating the minutes and a wedge the hours as shown on one of the cards reproduced on this page. Then by pulling the right lever toward the operator before the card is removed, two dials which form a part of the record are printed. One indicates hours, the other tenths of hours.



A sample card. It shows that workman No. 75 worked 3.2 hours in the morning and 2.7 hours in the afternoon on Order No. 92, on operation 63



The calculagraph, showing the two levers by means of which the cards are printed. At right of the picture it is shown in use in a factory where each job foreman reports by telephone to the timekeeper in the central office the record of each job



You don't need to scratch your phonograph records when starting them, for the flashlight shows you the exact position of the needle

A Flashlight To Show the Position of Talking-Machine Needles

SOMETHING new in the line of attachments for talking machines has been placed on the market by George E. Bernecker, a well-known Milwaukee electrical designer and inventor, who has developed a flashlight illuminating device, which makes it easy and safe to operate talking machines in the most subdued light.

The illustration above shows the flashlight attached to the machine. The light is flashed directly upon the path of the needle so that there is no danger of the record being scratched when the machine is started.

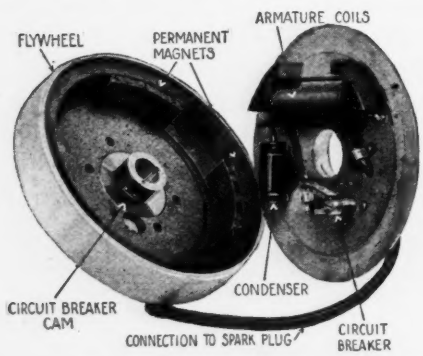
New Type Motorcycle Uses Two-Cycle Motor with Magneto in Flywheel

LOOK at the accompanying picture of a new motorcycle. Notice that it is not driven by gears and that it is very simple. Since a two-cycle instead of a four-cycle motor is used, as well as a flywheel magneto, the usual valves, gears and cams are dispensed with. The employment of the flywheel magneto eliminates a series of driving gears and sprockets so that the only drive taken off the crank-shaft is that of the main belt drive to the rear wheel.

The flywheel magneto is a new departure in motorcycle construction. It is cup-shaped and has a heavy rim, to the inside of which are attached a pair of permanent magnets as shown in one of the accompanying illustrations. The armature coils, the circuit breaker and the condenser are mounted on a circular plate which is carried on a boss on the crankcase of the motor and which fits snugly into the cup-shaped portion of the flywheel, without, however, contacting with the inside of the rim.

At every complete revolution of the flywheel the field magnets are brought into proper relation with the armature to induce the igniting current. At just the proper instant a cam mounted on the flywheel hub operates the circuit-breaker, causing the spark to jump the plug gap. The timing of the ignition is effected by loosening the clamps holding the stationary plate to the crankcase boss and rotating the plate slightly in the proper direction.

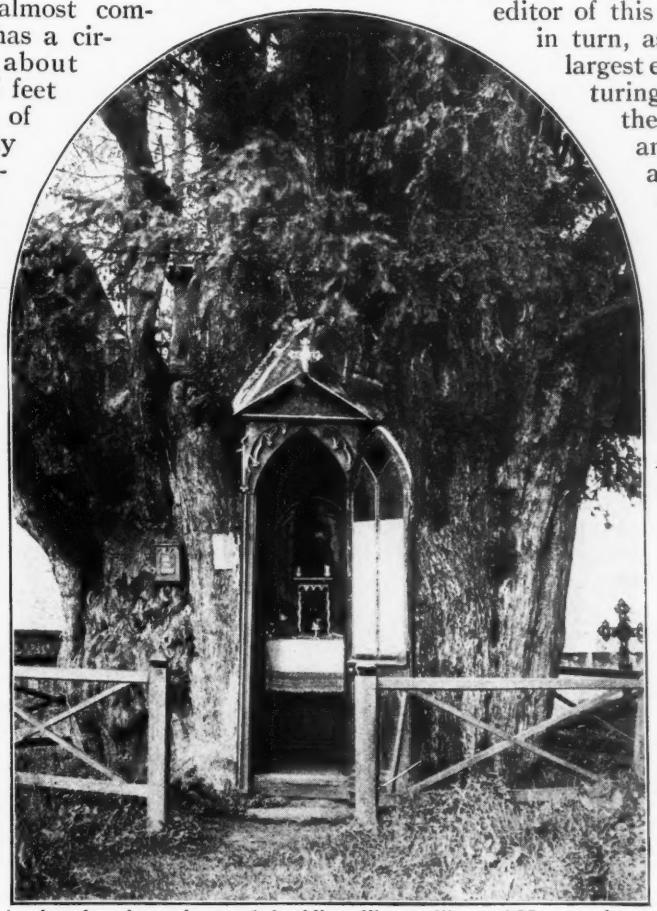
The advantage of such an arrangement is that there are fewer parts to be greased and cared for or to get out of order.



The flywheel magneto is cup-shaped and has a heavy rim to which is attached a pair of permanent magnets. There are none of the usual valves, gears and cams in this machine

Did the French Borrow this Idea from the Ancient Druids?

THERE are a number of trees in France which harbor picturesque little chapels. One of the most unusual is the oak of Allouville, a Norman village in the department of Seine Inférieure, in which the oak stands on a level piece of ground some distance from the church. Its trunk, which is now almost completely hollow, has a circumference at about three and a half feet above the soil of more than thirty feet, and its topmost branches are nearly sixty feet from the ground. This oak contains two altars, one above the other; the lower one is dedicated to Our Lady of Peace and was constructed towards the end of the seventeenth century by a former priest of the parish, the Abbé du Détroit. The chapel above the one to Our Lady of Peace is of much later date and is called the Chapel of the Cross.



An altar in a giant oak in Allouville, a village of Normandy. The tree is nearly sixty feet tall and about thirty feet around

The yew tree of La Haye-de-Routout, in the Department of Eure, is of an equally venerable age. The circumference of the trunk is about twenty-nine feet and its greatest height is fifty-seven feet. The little altar with a cross above the pediment is placed within the hollow trunk of the famous tree and the interior of the chapel is reached by ascending a step. On certain days a priest comes to celebrate mass at the altar, which is decorated with a group in carved wood representing Saint Anne "of the Yews" and the Virgin. Other districts of France also contain tree chapels.

Why Are Abandoned Flour Mills Not Utilized as Lighting Stations?

WHY are abandoned flour mills not used for lighting stations? Waterpower is to be had freely and abundantly, since the flour mill is nearly always the nucleus around which the oldest of our rural settlements have been built.

The question suggested itself to the editor of this magazine who, in turn, asked one of the largest electric manufacturing companies in the country to give an answer. After an inquiry among engineers in this plant and letters from more than six hundred milling establishments all over the country, it was proved that no abandoned flour mills had ever been transformed into lighting stations.

On the other hand the canvass brought forth the information that many milling firms furnish electric light and power in addition to the regular products.

In this connection it is interesting to note the various reasons given by mill owners for not using electric power in lieu of waterpower. Replies gathered from an extensive circular letter campaign show conclusively that the average miller would like to avail himself of the electric drive, but the economy of waterpower, the real or imaginary high cost of electricity, or the sacrifice of an expensive steam plant holds him back.

Out of six hundred and fifty-eight replies only ten wrote that they did not see the need for electric drive or were not interested in statistics concerning it.

Drying the Family Washing around the Stove

The cage is placed around the stove but far enough away to prevent scorching the articles draped upon it to dry. The clothes dry quickly

WHEN the weather prophet or the almanac predicts storms or bad weather, the up-to-date housewife does not postpone her washing. Neither does she order the clothesline strung up in the kitchen where it is an eyesore and in everybody's way, nor outdoors where the clothes might flop dejectedly for days in the rain.

Instead she sets up—if she is fortunate enough to have one—the clothes-drying apparatus which Benjamin Gallsworthy, of Port Arthur, Texas, recently invented. This is in the form of a latticed frame joined together in sections, upon which the clothes are hung. The ends of the vertical rods of the frame converge at the top forming a kind of cage. This cage is placed around a stove.

The heat from the stove dries the clothes quickly and makes it possible for the laundress or housewife to finish up the work regardless of the weather.

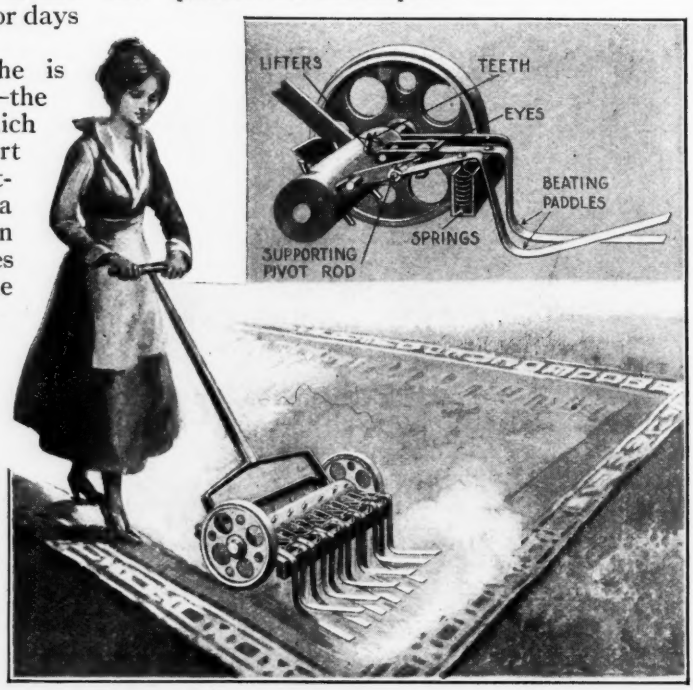
The sections of the cage are disconnected simply by removing the pins which join them, so that it is an easy matter to set it up or take it down. It can be easily stored away until needed.

A Machine Which Takes the Backache Out of Carpet-Beating

HOW would you like to beat your carpets with the same ease with which you push the lawn-mower over your grass or the baby carriage on the sidewalk? You can do it. You don't need to bend over until your back seems to be breaking in two, and your carpet will be cleaned just as thoroughly as if you pounded it with beaters in your own hands.

All this is possible with a new carpet-beater devised by Edward Smith, of Newark, New Jersey. Its operation resembles that of the lawn-mower. You run it back and forth over the carpet, which motion actuates a number of paddles that strike the carpet. The paddles are operated by teeth on a drum or cylinder which moves with the wheels of the apparatus.

The paddles extend in front of the machine and their upward movement is opposed by springs, these springs producing the beating movement. As the machine is moved forward the drum revolves, and its teeth come in contact with the paddles, lifting them up about four inches above the carpet when the springs force them to descend. This is the beating motion. The faster the machine is moved the faster the paddles hit the carpet.



Running the device over the carpet operates a number of paddles connected with the wheels. The faster the machine is moved the faster and harder the paddles beat the carpet

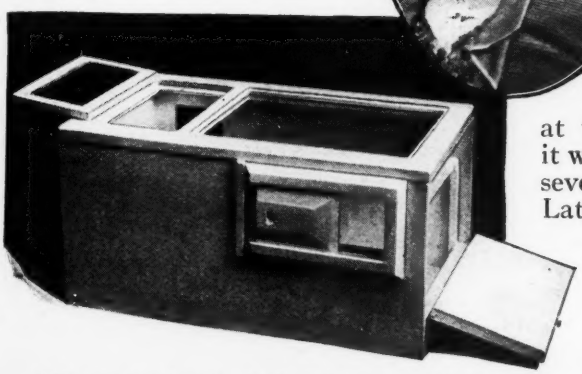
More Things Are Made from Yeast Than Good Cooks Dream Of

BECAUSE it is so essential in the making of bread and beer most of us think that yeast is useful for nothing else. But the Berlin Institute of Fermentative Industries calls attention to the fact that valuable flavoring extracts and tonics can be obtained from it and a relatively large percentage of muscle-building matter. Its remaining constituent, a mass of cellulose, can be used to make a very hard mass, known as ernolith, an excellent non-inflammable substitute for celluloid.

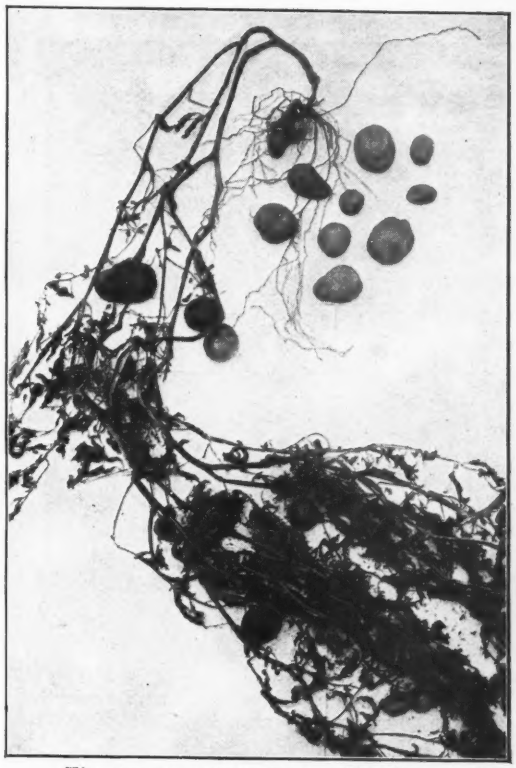
A Baby-Incubator Made Out Of an Old Soap-Box

ANOTHER use has been found for the time-honored soap-box, though why all boxes of a certain size and shape should be called soap-boxes Science itself has not as yet been able to decide. At any rate Dr. Alice M. Seabrooke, Superintendent of the Woman's Hospital at Philadelphia, Pa., has invented an incubator which can be made from a box of the conventional soap-box type. The model, shown in the illustration, was exhibited at the annual convention of the American Hospital Association.

The incubator contains all the features of the expensive types, with arrangements for heating and moistening the air and for keeping the temperature under control. It is provided with a glass top with two sections. There are well-protected openings on all sides so that the little patient can be watched and attended without being disturbed.



The box incubator which was constructed at a cost of five dollars. Above is a photograph of Dr. Alice M. Seabrooke, of Philadelphia, who invented it



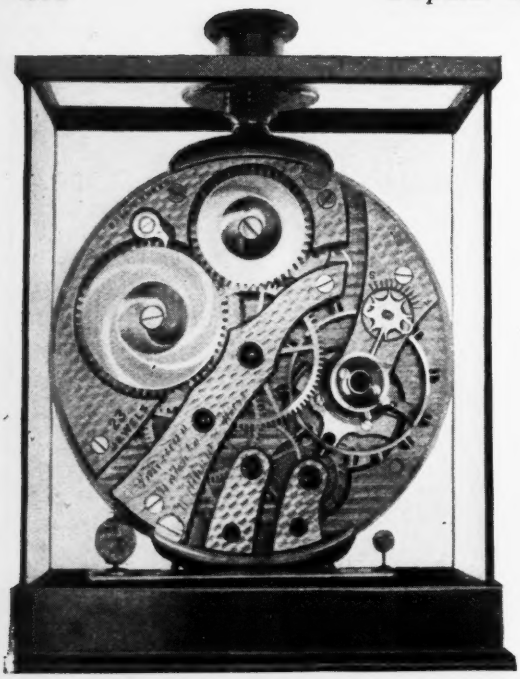
The tomato-potato plant, with tubers underground and perfect tomatoes above. The plant bore abundant crops of both products

Growing Potatoes on the Roots of a Tomato Plant

CONSIDERABLE interest has been aroused by the grafting of a tomato plant on a potato plant at the Pennsylvania State College. Although the idea is not a new one, it demonstrates clearly the ease with which these two closely-related plants may be grafted.

Only one attempt was made in the grafting. The common inverted "saddle graft" was used. The plant was wrapped with raffia at the junction of the two pieces and it was placed in a humid atmosphere for several days until the union was perfected. Later the plant was shifted to the outside, where little attention was given it. Tubers finally developed on the potato part and tomatoes on the top.

According to the authorities themselves, the demonstration is of interest only from the standpoint of its being somewhat unusual. It is of doubtful economic value.



The watch in the center is the largest in the world. At the left below is an ordinary-sized watch and on the right the smallest ever made

The Largest and the Smallest Watches in the World

THE ordinary watch is a simple, comfortable time-piece to be dropped negligently into a convenient pocket and to be referred to casually and without inconvenience. But all watches are not thus easily handled. The largest watch in the world, for instance, could hardly be carried conveniently at the end of a fob, since it weighs one hundred and fifteen pounds, while the smallest watch in the United States could be easily lost in a vest-pocket of change, since it is scarcely larger in circumference than a dime. Aside from their unusual sizes, these big and little watches differ in no respect from their brothers of normal development. They keep excellent time and perform in all respects as an orderly, well balanced time-piece might be expected to do.

The watches, contrasted here, were built originally for advertising purposes.

The smallest watch has a diameter of only seven-tenths of an inch, and a circumference of two and one-fifth inches. Its weight is .113 ounce Troy. The big brother of the smallest watch weighs one hundred and fifteen pounds; it has a diameter of seventeen inches and a circumference of fifty-three and two-fifths inches. Both watches are stem-winders, though to wind the smallest one it is necessary to use a pair of little tweezers.

The larger watch has twenty-three jewels. It cost more than ten thousand dollars.

Directing Newport's Traffic from a Portable Platform

TRAFFIC Policeman Freeborn Coggeshell, of Newport, R. I., has solved the traffic stand problem all by himself. He has constructed a platform which meets the peculiar conditions of the difficult post he holds, which is situated in a five-cornered plaza to which traffic converges at an average of twelve hundred vehicles of all descriptions an hour.

Two streets have a grade of about thirty-five degrees, and all are narrow and dangerous. Only at one point may a policeman stand in order to have a clear view to regulate traffic, and there it is that Policeman Coggeshell and his platform are located.

The policeman wheels his platform to the point at which all five streets cross, and with the aid of a mirror watches the traffic in every direction

Since Coggeshell has been directing traffic in the square he has stopped one hundred and three runaways. That is the main reason he has equipped his platform with a mirror to show him what takes place behind him. In the mirror he obtains a view of the square and several streets.

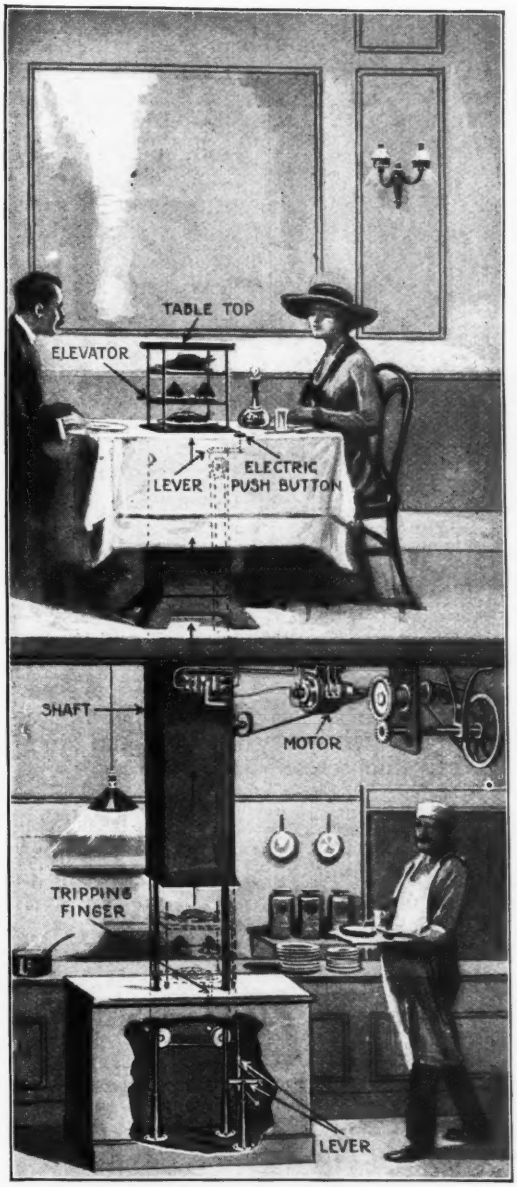
The umbrella insures a most welcome protection from the sun, rain, and snow. In stormy weather a burlap apron is fastened around the stand to protect the officer. When the day's work is done Coggeshell wheels his platform to a nearby store.

Eliminating the Waiter in the Restaurant

A DETROIT man, John F. Daschner, has a plan for eliminating the restaurant waiter and putting in his place something which doesn't talk, or hold out its two hands for tips, or spill the soup. His invention is a dumb waiter in more than one sense. The system is said to embody the luxuries of a select dining-room equipped with conveniently arranged tables and comfortable seating facilities wherein patrons may dine with ease and privacy, receiving prompt, efficient and sanitary service at reasonable prices.

While the system eliminates the waiter in the dining room it utilizes him as a serving department attendant, where his duties are less arduous and where he is not subjected to the whims and caprices of critical patrons. No money is wasted on waiters' uniforms or dress suits, nor is there any scurrying of waiters.

The table at which you sit is the top of an elevator shaft leading to the kitchen below. The elevator is operated by a cable passing over a series of pulleys to a motor-driven drum. Simply by manipulating a pushbutton in the table top the elevator descends to the kitchen, where it is loaded and sent up again. A tripping finger automatically arrests the elevator at the top or bottom of the shaft.

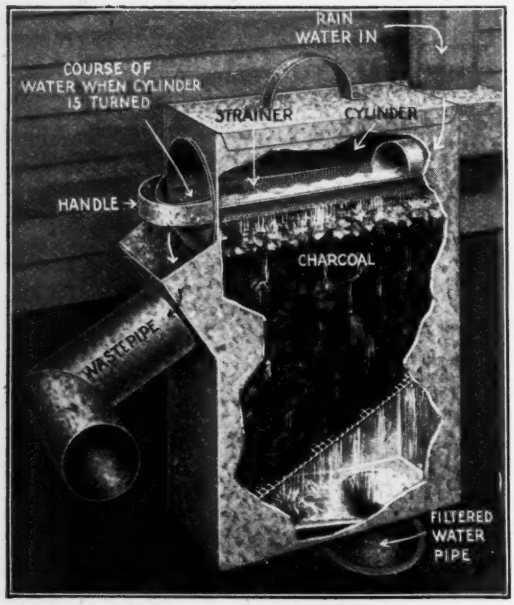


Check off on the menu card the dishes you want, press a button in the table-top and the dumb-waiter descends from the center of the table to the kitchen below, where the order is filled and then sent up by the same route

We Don't Eat This Fish Because It Is Unfashionable

IT seems as if there are fashions in fish just as there are in wearing-apparel. A fish that brings in German markets nearly four times as much per pound as our fresh mackerel, and considerably more than haddock, is thrown away by our fishermen because no one wants to eat it. And it is mighty good fish, too. Those who eat it praise it for its delicate flavor. Even the English like it. Every year they consume three thousand tons of it. Yet we will have none of it.

This fish is known as the goose-fish, angler-fish, devil-fish and monk-fish. True, its appearance is against it, but still the epicures in England and Germany demand it because it is delicious. Analyses made by the Bureau of Fisheries on samples show that goose-fish contains considerably more protein than flounder, slightly more than a cod, a little less than halibut, and considerably less than sirloin steak. The goose-fish has an average length of three feet and is broad and flat, somewhat resembling the flounder in general outline. The only way to get it, says a Philadelphia woman, is for the housewives to club together and demand it. At the present time fishermen do not take the trouble to bring it home, but discard it from their nets.



A rectangular box containing a bed of charcoal and a screen is fitted to the roof leaders

Filtering Rainwater from the Leaders Through Charcoal

DESIGNED to be fitted to the roof leaders of a country house to filter all the rain water flowing into the cistern, the simple filter shown in the illustration above consists of a rectangular box with a bed of charcoal and with a removable cylinder at the top. One half of the cylinder is a screen and the other half is of solid galvanized iron. When the screen half is at the bottom, the water flows through it and thence down through the charcoal bed into the pipe leading to the cistern. The strainer catches the large refuse, such as leaves, and the charcoal removes the finer particles of objectionable matter.

When the cylinder screen is at the top the water collects in the solid half until it overflows and passes out through a waste pipe to the ground. A removable lid is provided so that the leaves and other refuse which collect in the strainer may be easily removed without inconvenience.

Taking Care of Honey Bees During the Winter

BEES, as a rule, take care of themselves. It is their ability to do so which makes them valuable to man; for the honey they provide is not intended for any other use than their own. But in order to help them keep in such good condition that they will produce honey enough for themselves and an abundance to spare, it has been found advisable to keep them warm in winter by insulating their hives thoroughly, top, bottom and on all sides.

According to the Chief of the Bureau of Entomology, the choice of insulating materials is of minor importance. The materials commonly used—shavings, sawdust, leaves and chaff—do not differ greatly in insulating value. It is the amount of protection afforded which is the chief consideration. Bee-keepers have claimed that over-insulation is detrimental; but the Chief of the Bureau insists that exhaustive tests have proved that it is scarcely possible to provide too much protection for the bees during the winter months and the spring.

A Hot Plate Camp Stove for the Automobile Tourist

WHY build a fire to cook your meals while you are touring the country, when the tank supplying the gas for your headlights will perform the trick for you? The only equipment necessary, aside from the tank and a match, is a hot plate stove, weighing but six pounds, and small enough to be packed away under the seat. When the gasoline is turned on full the stove consumes about three and one-half feet of gas an hour giving a flame sufficiently intense to boil a quart of water in three minutes.

The tank supplying the gas for the headlights will furnish fuel for the cooking, when a hot plate is used

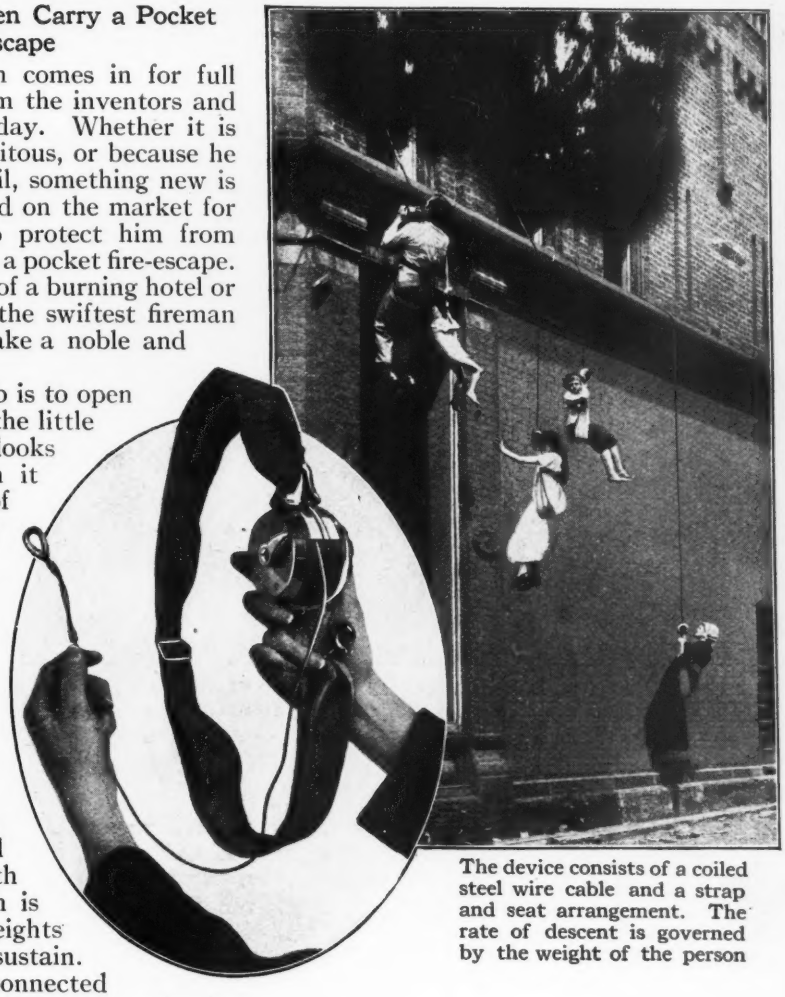
The stove consists of several burners and a plate upon which the food to be cooked is placed. All that is necessary to prepare the stove for use is to slip the rubber tubing on the hot plate.

The plate can be used in the same way as the small electric stove.

Afraid of Fire? Then Carry a Pocket Fire-Escape

THE traveling man comes in for full consideration from the inventors and experimenters of the day. Whether it is because he is so ubiquitous, or because he is such a necessary evil, something new is constantly being placed on the market for his convenience or to protect him from danger. This time it is a pocket fire-escape. With it he can get out of a burning hotel or other building before the swiftest fireman can get a chance to make a noble and spectacular rescue.

All that he has to do is to open his suitcase, take out the little aluminum box that looks like a soap-box, open it and attach the end of the coiled steel wire cable to any available hook or loop it around the bed-post or other piece of heavy furniture, fasten around his body the strap and "seat" arrangement which is part of the device, and then hop out of the window. The casing containing the steel cable is provided with an indicator on which is clearly marked the weights which the cable will sustain. This indicator is connected with a control which adjusts the mechanism in such a way that the rate of descent is governed by the weight sustained. For instance if a man weighs two hundred pounds, he turns the indicator until it points to that number and his drop is no faster than it would be if he weighed only one hundred pounds and turned the indicator to one hundred. In this way the shock of a sudden drop is avoided, although you can go down twenty stories in one minute. The limit of the carrying capacity of a one hundred and fifteen-foot cable is two hundred pounds, but another size is manufactured which will sustain four hundred pounds.



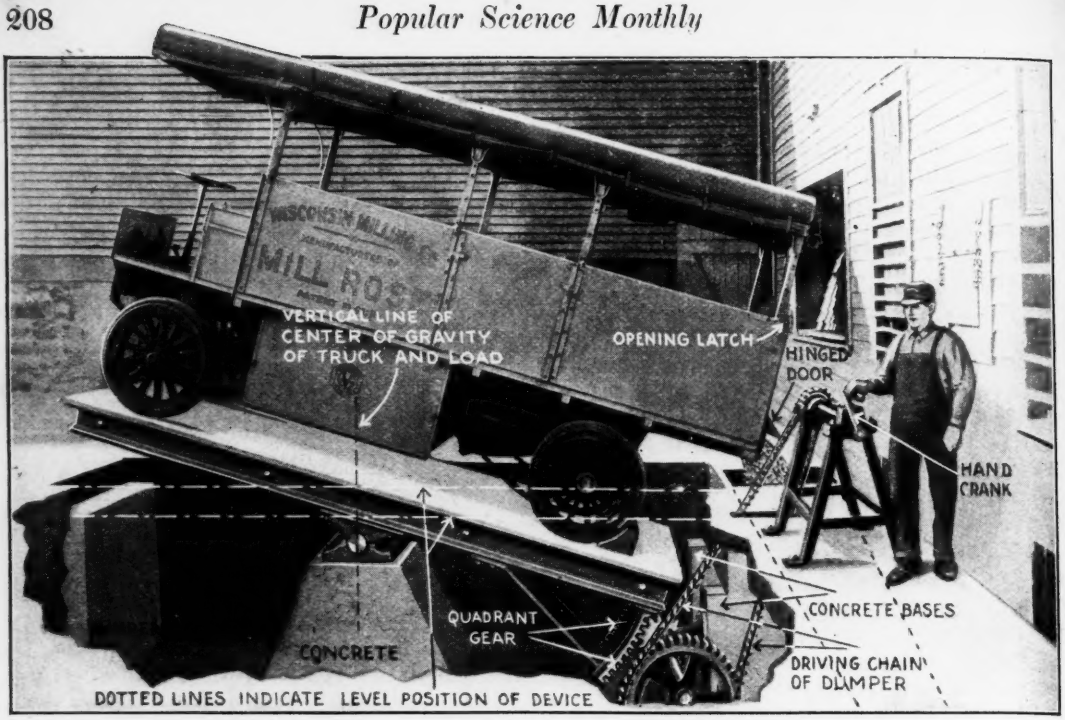
The device consists of a coiled steel wire cable and a strap and seat arrangement. The rate of descent is governed by the weight of the person

You can go down over the porch or from a steep roof, and if you should become unconscious from fright you are still safe. Besides being of value to the traveler, it would seem to be a convenience to firemen, also. Even children can use it.

How a Whale Fought a Submarine and Sank Her

THE vessel "*W. S.*" was recently sunk by a submarine without warning and within sight of the coast-line of Florida. The vessel was damaged so badly that it sank within ten minutes, its crew barely escaping with their lives. A monster whale on coming to the surface, came up against the sharp keel of the vessel, and it must have received a disagreeable cut, for it immediately attacked the boat and with one whack of its tail stove a large hole in the vessel's bottom. The water filled the boat to its deck in less than ten minutes and it went to the bottom almost immediately.

While this matter cannot be directly traced to any warring nation, it is possible that the whale learned its bad habits from the manner in which other neutral vessels have been sunk in the last few years.



A pivoted platform is constructed flush with the roadway in front of the bin in which the truck is to be unloaded. By turning a crank five tons can be dumped in a minute

To Unload This Truck You Simply Tilt the Platform

A WESTERN milling company has found it profitable to use motor trucks which can be tilted in their entirety. The plan pays because the longest truck run is not more than eight hundred feet. All motor vehicles of any kind turned out to be failures because they lost too much time being loaded and unloaded.

Study the accompanying illustration and you will see that the tilting device consists of a pivoted platform flush with the roadway in front of the bin in which the load of the motor truck is deposited after it has been carried from another part of the plant. The fulcrum of the platform coincides with the vertical line through the center of gravity of the truck with its entire load. This makes it extremely easy for one man to tip the entire vehicle, simply by turning a crank-handle at the side of the truck. The crankhandle is connected by means of chains and gears with a large toothed gear sector bolted to the under side of the platform.

After the grain has been dumped, the platform and the truck swing back to the level position by a half turn of the crank-handle, simply because the truck is heavier in the front than in the rear when empty.

How Much Do You See When You Look at an Object?

THE various committees and individuals interested in the "safety first" movement are agreed that although the movement is still in a progressively fluid state there is not much more that can be done until the individuals most concerned are taught to use their eyes more effectively. "Having eyes they see not," is the plaint of those who would safeguard the general public from the hundred and one accidents that daily occur.

It might prove pleasurable to compare notes on observation. Let two people, for instance, take the same walk or view the same object for the same length of time and then tell about. It will be found that hardly one out of ten will notice more than the most obvious facts. It was the custom of one of the old philosophers to give a new student some simple object—in one case it was the head of a fish—and tell him to study it and then tell all he knew about it. The student usually returned in about an hour's time with a completed paper on the subject; but the paper was generally returned with the remark that if it took an hour to learn such a little it would require a month perhaps to get a fairly good grasp of the subject.

All papier-mâché heads look alike when they come to Miss Stevens. When they leave her they are distinctive enough to be named

Photos Paul Thompson

Here they are, just as fresh as if they stepped out of Madame's shop in Paris. The third one from the right is not sleepy but demure

Hats Are Made for Personalities—Not for Heads

AFTER all, hats are made for personalities. If you want to be convinced look at a collection of bonnets in a smart shop window. Notice how lonesome they look hanging from hooks and supported stiffly by iron rods.

Now picture to yourself how much prettier they would look if there were human heads in that window to wear them, tilted at the proper angle.

Of course shop owners have known of this problem for years, but they never thought seriously of solving it—not until Frances Simpson Stevens came along with her samples of papier-mâché heads and showed them just how different a hat looks when it tops a coy and demure, or a chic and mischievous face. The shop owners who took time to listen to her are glad they did now. For papier-mâché heads are all the rage.

Miss Stevens is an American girl who has studied art in Italy and France. The heads which she makes are of as many different kinds as there are different types of personalities.

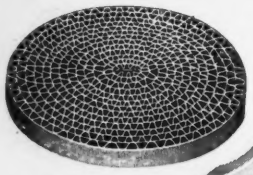
When little wooden Johnny is spoken to, the "ventriloquist's" assistant has no trouble at all in hearing and answering

Is This the Secret of Some Vaudeville Ventriloquy?

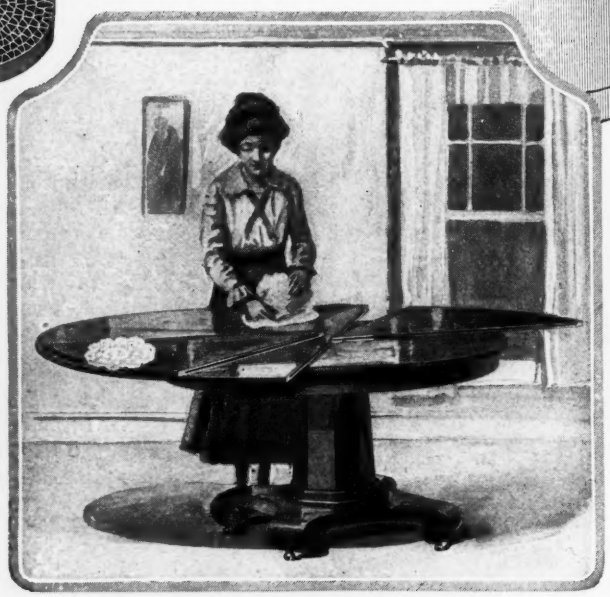
LITTLE wooden Johnny is an actor who is frequently seen on the vaudeville stage. Haven't you often wondered how well he speaks? He sits contentedly on the lap of his sponser, and without the least trace of bashfulness, or hesitation he tells the audience whatever they want to know.

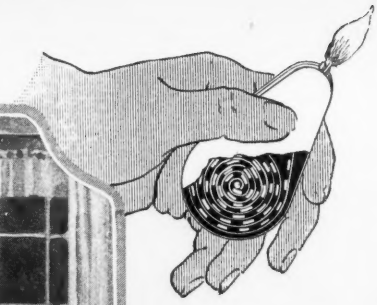
Let us look into the secret of the talking dummy. Ventriloquism is one explanation; but a simpler one is to be found in a patent which has recently been granted to Charles M. Price, of Boston. From the ventriloquists' point of view, Mr. Price's idea is distinctly an improvement on the "regular" way. A telephone receiver is secured in the hollow head of the dummy. Connected with it are ordinary telephone wires which lead to a transmitter under the stage and speaking through this is a man. Placed in the dummy's stomach is a telephone transmitter, which is connected with receivers on the assistant's head, so that he knows just when and what to answer.

Housekeeping Made Easy



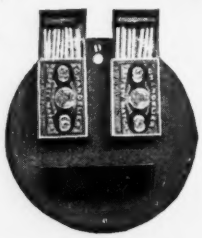
Above: A new device for waxing flatirons consists of a round honeycomb board about five inches in diameter, which is saturated in beeswax



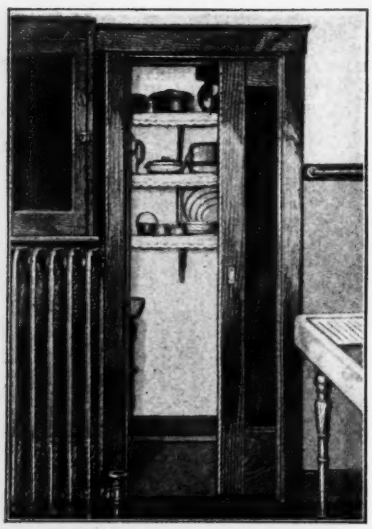


A lighter which is composed of a roll of one hundred caps which are ignited one by one by an upward push of the thumb. Each light burns half a minute

Above: A table top made in eight sections, which will fit any table, round or square, and enlarge it for special occasions. The sections are plush-lined so as not to scratch the wood

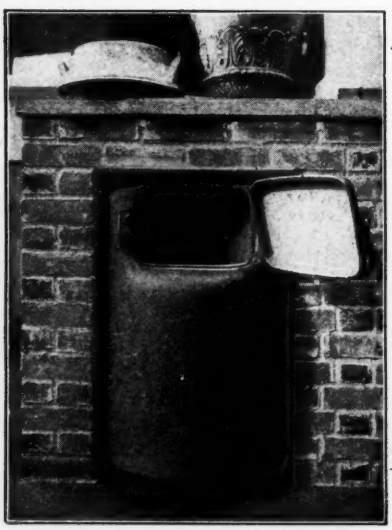


At left: These steel match holders are equipped so as to accommodate the ordinary parlor match or to hold two boxes of safety matches. They are fastened on the kitchen wall



A sliding door for the pantry is a convenience where a swinging door would be impossible or very much in the way. When closed it looks like a panel of the wall

A coat hanger which you can carry in your pocket. It is about two inches long but will hold sixty pounds. It is easily pressed into the wall or woodwork

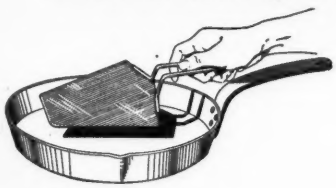


A cast-iron garbage receiver built into the kitchen wall so that the front opens into the kitchen and the back upon the rear porch or into the back yard

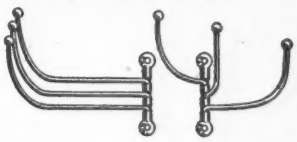
Ice-grips composed of wooden handles in which are set spikes, or teeth, will prove a convenience in lifting ice from the dumbwaiter to the refrigerator

In oval above: A vacuum-cup massaging device which has a grip nearly twice as strong as that of the ordinary type of vacuum cup

A folding stand to raise the dishpan a few inches if the sink is low. It may also be used as a rest for hot pans when taken from the oven

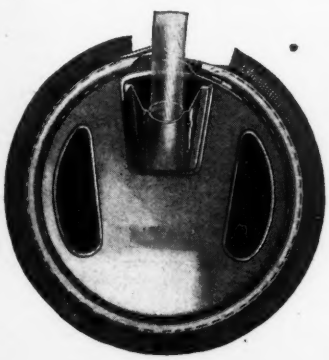


A broad flat knife of flexible steel for turning pancakes, eggs, etc. It has a sharp edge and can be used for chopping vegetables



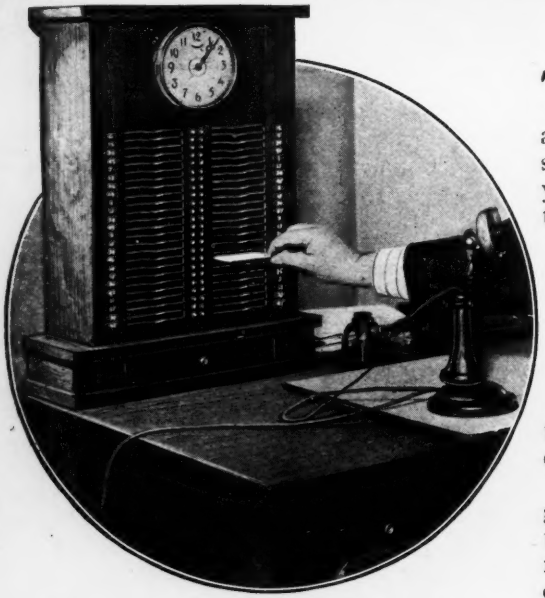
A nickel-plated steel coat and hat hanger with movable arms which can be placed in any desired position or folded back against the wall out of the way

Below: A mop head which locks over the mop cloth holding it securely but releasing it readily when it is no longer needed



A device without springs and with but a single operating cord for opening and closing casement windows, transoms, shutters, etc.

Below: An adjustable carriage or support on casters for a scrubbing pail. It also has a caster bracket mop wringer which is operated by foot pressure



You can't forget your appointments if you write them down on cards and place them in the right compartments in this machine

Do Your Remembering by Electrical Machinery

DO it electrically! The "remindograph" is an application of that slogan to the task of remembering. It consists of a wooden cabinet in which there are a number of small pigeon-holes, enough for every quarter hour in the day. On one side of each is the time of the quarter-hour to which the pigeon-hole corresponds, while on the other side is a small electric lamp. At the back of each hole are electric contacts or brushes between which a strip of metal can be placed or taken out at will. This strip can be fitted upon a small card, and when such a card is placed in a pigeon-hole an electric battery circuit is closed to corresponding connections on what may be called an "alarm clock." Hence when you have an appointment for 2:15, you simply insert one of the cards in the pigeon-hole marked 2:15. As soon as the clock points to 2:15 an electric buzzer rings and the lamp lights. This will continue until you take out the card.

The machine tells you how much you weigh and shows you what to eat to increase

Directing the Fire of a Big Artillery Gun

TO-DAY there is about as much difference between aiming a big gun and aiming a rifle as there is between sailing a superdreadnought and sailing a steam yacht. It was not very long ago, however, that a gun was aimed similarly to a rifle in that the direction in which it was pointed was obtained by sighting along its barrel. But now things are not done that way. The gunners in the European war, for instance, are often far out of sight of what they are shooting at, and the remarkable hits that they make are only explained by the use they make of careful scientific calculations.

To direct the fire of one of the bigger guns, for example, requires that no less than fifteen complicated corrections be made. Each correction requires an average of five adjustments, all of which must first be exactly figured out by those in command. The most important corrections which are made are for the influence of the resistance of the air, the influence of the earth's curvature, and the attraction of gravity on the distance the bullet may be carried. In place of the guess-work of previous times is the use of the most advanced developments in the fields of mathematics, physics and chemistry.

A Weighing Machine in a Restaurant Show-Case

THE latest thing in restaurant fixtures is a weighing machine built directly in a show-case. Doctors are beginning to feel that the condition of a person's health is usually shown in his weight. When you lose weight, rest assured that something has gone wrong and that your health has suffered as a consequence. The restaurant keeper has a legitimate interest in keeping your weight normal. The index of the new scale will indicate your health, and the show-case will tempt your appetite, or coax it along if you have none, and will tell you what you ought to eat.

Enlightened Liberty Enlightens the World

Bartholdi's famous statue now sends out its message by night as well as day

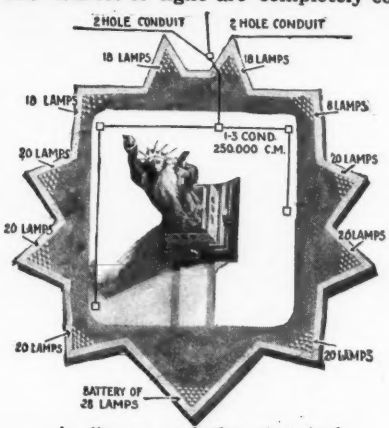
THE Statue of Liberty, gift of the republic of France to the United States, has been brought out of the darkness that has hidden her every night these thirty years, and henceforth she will be bathed in the perpetual daylight of the incandescent lamp.

In many respects the lighting of Bartholdi's famous statue is the most remarkable work of its kind in America. It may be regarded as the climax of three years' effort and development in the art called "flood-lighting." The Woolworth tower was the first permanently flood-lighted building and the lessons learned in this installation were carried out with notable success in the flood-lighting of the Panama-Pacific Exposition.

The idea of applying this dignified and impressive method of lighting the Statue of Liberty was conceived in 1915. A popular fund-raising campaign was conducted by a New York city newspaper and the statue made her debut as a permanent lighting spectacle during America's "electric week."

© Int. Film. Serv.

The Statue of Liberty transformed from a somber bulk into a goddess bathed in a permanent flood of light. The sources of light are completely concealed



A diagram of the electrical installation, showing the positions of the projectors

Except for a slight modification of the torch, nothing was added or taken away from the statue. The purpose of the designers was to transform the dull lantern in Liberty's hand into a flaming torch. This was accomplished by removing the somewhat crude steelwork, which, in a way, had distorted the classic contour of the torch, and substituting sheet bronze for it. The whole torch was thus rebuilt to obtain a bronze flame of the shape and size originally intended by Bartholdi. Gutzon Borglum, the sculptor, supervised this work.

When the torch flame was completed all the bronze plates were cut out, leaving as a skeleton riveted lines about an inch in width. These plates were then used to construct molds upon which pieces of glass were bent. In selecting the glass Mr. Borglum picked out three tones of yellow cathedral glass. A dull surface was preferred to avoid the blinding noonday glare of a rich reflective surface. The lightest tint was used to simulate the tip of the flame, with

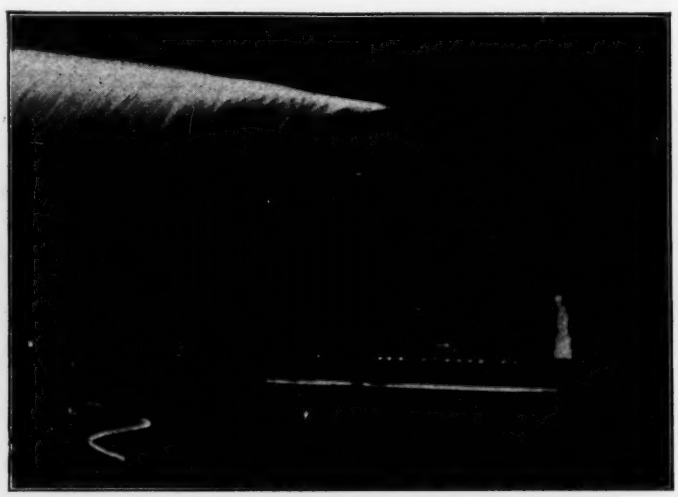
© Press Illus. Serv.

New York's skyline by night is the most impressive sight of its kind in the world. The night the Statue of Liberty was illuminated, at which time the above photograph was taken, the buildings on Manhattan's shoreline stood out in brilliant array, a light in every window. The buildings

slightly darker pieces inserted here and there variously down to the base of the flame, where the darkest of the tints defined the lines of the bronze of the torch against the glass of the flame.

It took six hundred pieces of glass, each about one inch square, to complete the glass area of the torch. The glass is so fixed to the ribs that any section may be replaced at any time from the inside. Spring clips and non-hardening putty, separating the glass from the brass bolts which hold the plates to the ribs, provide a resiliency which practically insures the glass torch flame against breakage.

To make the torch represent a burning flame, fifteen five-hundred candlepower gas-filled electric lamps were connected with a flasher. A flasher is merely a rotating drum containing surface projections which close the lamp circuits every time they hit a stationary piece of metal. The flasher connected with the Statue of Liberty lights is not set to certain revolutions, the experts preferring to allow it to carry out the unsteady flicker and blaze of the burning torch. The torch also contains a lighthouse lens, nine and one half inches in diameter and fifteen inches deep. Thus the torch sends out a flickering light and a constant glow.



At the moment the statue was bathed in light Ruth Law, the flyer, swept like a comet across the sky, two streams of white magnesium flame trailing behind her aeroplane

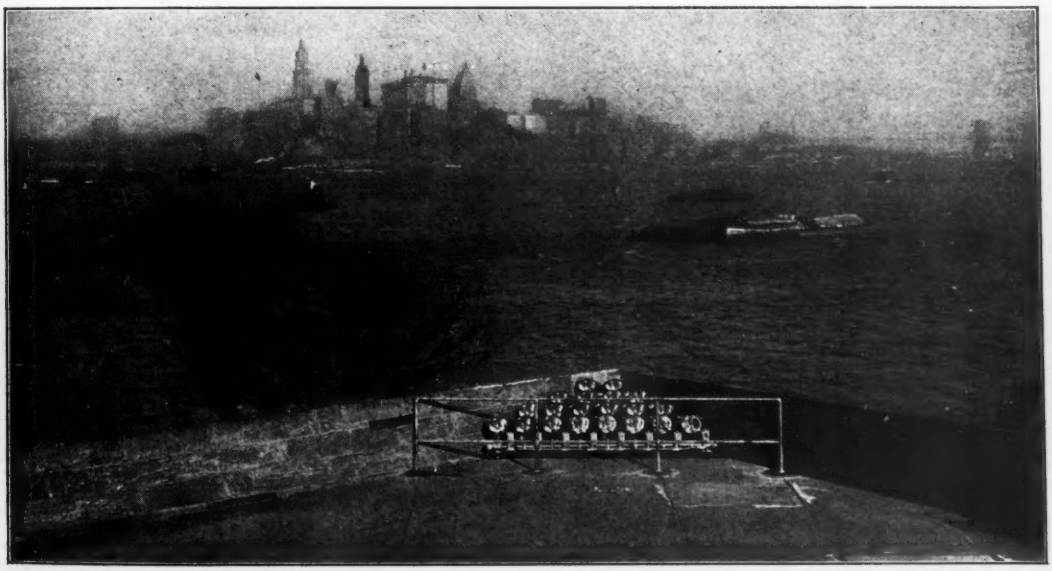
The sources of the flood lights are fifteen batteries of projectors. Eleven of these batteries are

most brilliantly visible are the Municipal at the extreme right; the Pulitzer, home of the New York World; then the mighty Woolworth, king of the skyscrapers; the Singer; the Adams' Express Company Building; the Banker's Trust; and at the extreme left the Whitehall Building

located upon the eleven salients of Fort Wood, upon which the base of the statue is built. Three batteries are located upon the roofs of small buildings on the island. One battery is just below the torch.

The total number of projectors is two hundred and forty-six, each projector being equipped with a two hundred and fifty-Watt incandescent lamp. Each projector has its individual compensator to step down the two hundred and twenty-volt current to the lamp voltage. Both projectors and compensators are mounted on specially designed pipe-framed conduits.

The electric current is supplied by the Public Service Corporation of New Jersey.



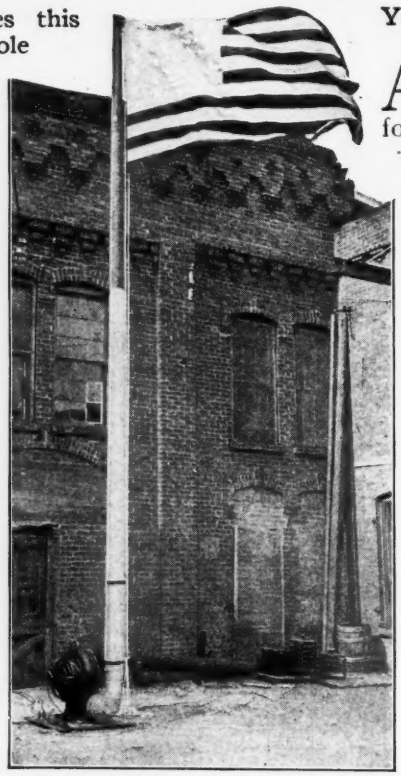
Photographed for Popular Science Monthly by Levick

One of the fifteen batteries of projectors located on one of the eleven salients (angles) of Fort Wood, upon which the base of the Statue is built. There are twenty lamps in this one battery

An Electrical Wind Waves this American Flag on its Pole

THE sight of a flag waving from its staff in a seemingly quiet atmosphere in Atlantic City recently puzzled everyone who saw it. Only after a careful examination of the flag and the pole did it become apparent that the pole was really blowing the flag.

The pole was a metal tube twenty-seven feet high and five inches in diameter at the top and nine inches at the bottom. It was set over the exhaust port of an electric motor-driven blower, hidden from view by foliage. For a distance of nine feet from the top, the pole was perforated with two rows of holes drilled close together. With the blower in operation it was the blasts emitted through these holes that held the flag and imparted to it the waving motion shown in the illustration.



The pole blows the flag whether there is any air stirring or not. The effect is the same even indoors

A Simple Method for Pasteurizing Milk

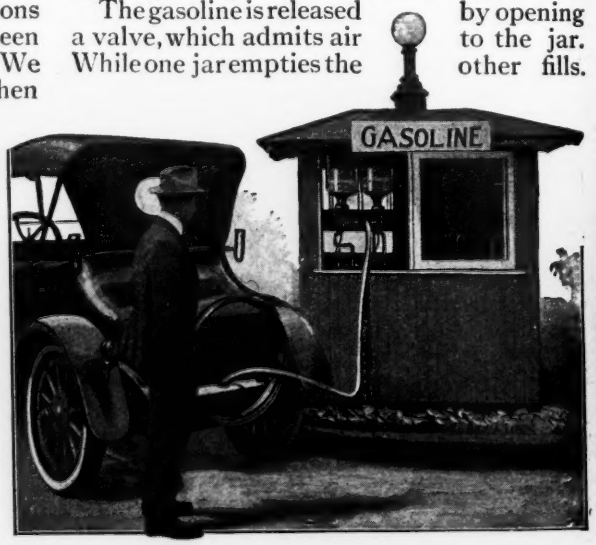
ONE of the most important contributions from the medical profession has been the simple process of pasteurization. We can only realize what it has meant when we consider that of all the dairy cows in the United States, forty per cent have tuberculosis. It is therefore evidently very important that every bottle be pasteurized before being used; and if that has not been done by the dealer, it can be effected without much trouble in the following way:

The bottles are placed in a wire basket and slowly heated in a vessel of water to just boiling. Here they are left for five minutes; then they are again cooled by allowing cold water to run into the vessel. The bottles must then be stored at a temperature of not more than fifty degrees Fahrenheit. If the temperature should be just about fifty degrees, wet woolen cloths will lower it enough.

You Can See Your Gasoline in This Service Station

A NEW departure in gasoline service stations for automobilists has been invented by Henry E. Maurer, of Springfield, Illinois. The patented device includes a system for the accurate measurement and dispensing of gasoline which allows the motorist to see the gasoline that he is receiving. Furthermore the dealer does not have to turn the crank of his pump as each gallon is measured out. The entire apparatus is operated by the vacuum process and eliminates any possibility of mistake in giving an accurate measurement.

When the motorist drives up to the station he receives his gas from two five-gallon glass tanks. These tanks are marked with gages that are inspected at intervals and sealed by the inspector. As the gasoline flows out of the glass receptacle the motorist is given a chance to see exactly what and how much he is getting. The flow is automatic. The gasoline is released by opening a valve, which admits air to the jar. While one jar empties the other fills.



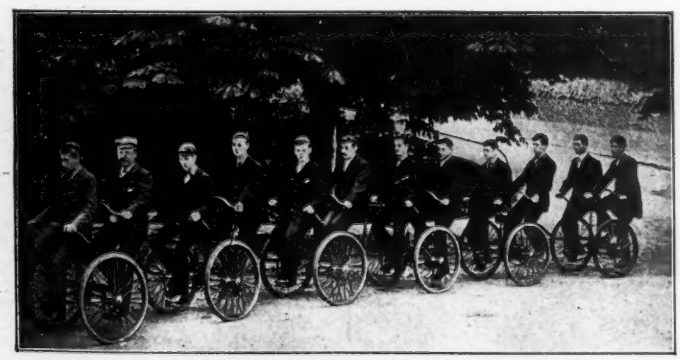
There is no guesswork in measuring your gasoline with this device. You can see for yourself by watching the gages how much you are getting

Twelve Blind Men Go Bicycling on a Curious Machine

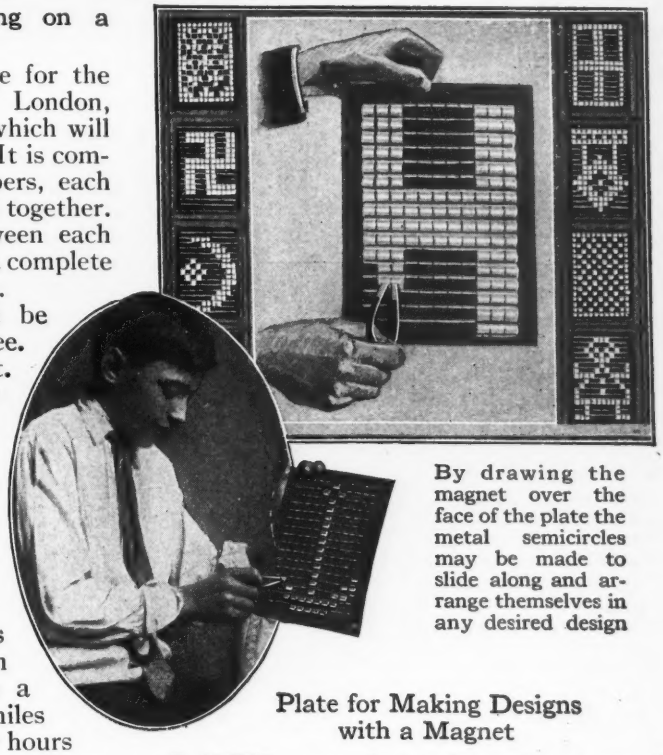
AT the Royal Normal College for the Blind at Upper Norwood, London, England, a multicycle is in use which will carry a team of twelve cyclists. It is composed of six two-wheeled members, each adapted for two persons, coupled together. There is a connecting bar between each successive pair of wheels to form a complete train twenty-eight feet in length.

Obviously the machine must be guided by a person who can see. This person is in the second seat. The slightest deviation to either side of the front wheels is transmitted through the coupling bar to the second pair of wheels, the drivers of which can act in concert, thereby conveying the same information to the third unit, and so on to the end. The sharpest curves can easily be rounded. Often long excursions are taken into the country. On one occasion blind men made a trip to Brighton, one hundred miles distant, in ten and three-quarter hours of actual running time, or an average speed of nine and three-quarter miles per hour.

In this way, although each man has all the enjoyment and freedom of motion which is obtained in riding a separate bicycle, the balance is preserved just as surely as it would be in a long, narrow, twelve-wheeled truck. Moreover, the appearance presented is not that of blind men being conducted on an outing. To the average observer, the riders are twelve normal men working individually and in perfect unison. None but the afflicted can realize what this means to the blind.



Twelve blind men enjoying an outing on their multicycle. The element of danger from falls is practically eliminated



By drawing the magnet over the face of the plate the metal semicircles may be made to slide along and arrange themselves in any desired design

Plate for Making Designs with a Magnet

A NEW game that takes advantage of the child's delight in playing with a magnet is so constructed that letters, numerals, and other designs may be worked out. The essential part is a slotted metal plate. In each slot there is suspended a semicircle of silvered sheet metal, which slides freely through the slot but cannot drop out. The semicircles are all turned in the same direction. By drawing the magnet over the face of the plate they may be drawn to the front so as to make the design desired.

The game is not only amusing but also may be used to teach the younger children the form of the different letters and numerals. An ingenious boy with some knowledge of the rudiments of constructional drawing can make any number of designs with the device and will derive much pleasure and practise from it. As an amusement for a youngster convalescing from an illness the idea is excellent, for it will keep his mind employed without in the least tiring him or over-exciting his imagination.

Putting the Finishing Touches to a Collar by Machinery

THE home of the first collar, Troy, New York, is also the home of the latest improvement in collar machinery. By the new power-driven finishing machines manufactured there, three distinct operations are now performed where only one was made previously. The machines contain four attachments, each consisting of a lower and upper mold. The thickness of the sides of the cup-shaped lower mold is equal to the thickness of the tie-space that is required between the two bands of a collar.

When two collars are fitted to two of the attachments and a lever is pressed, the upper molds of the attachments are automatically pressed downward against the two collars. At the same time, steam is admitted between the two molds as they press against the collar. The action of this steam for only a few seconds causes the starch to soften so that any starch cracks that may be present are deftly removed as their edges heal together.

A collar-finishing which performs three different operations within five seconds

The thickness of the inner mold produces the tie-space. The pressure of the molds smooths the collar and at the same time makes it round so that its two points will match when the collar is closed. All this is done in the one operation in five seconds.

While this is going on, two more collars are placed on the other attachments, and while these are being "finished," the first two collars are released. In this way no time is lost and as many as twenty collars are done in one minute.

The Ever-Popular Pickwick Chair and Toy Table

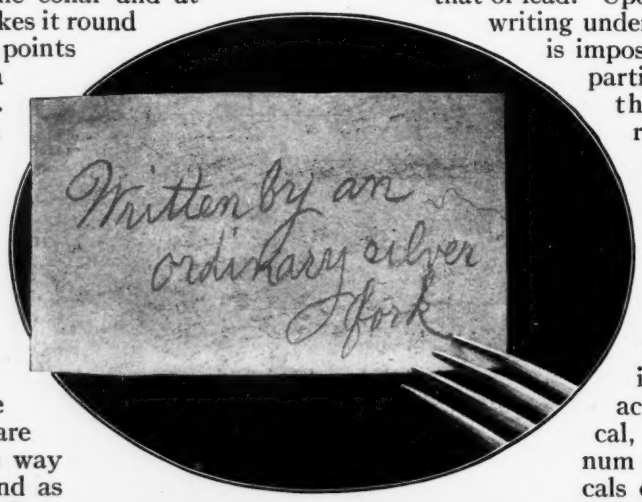
THE Pickwick chair is the most popular piece of furniture in the nursery. The chair is of wood, carved and painted like a seated figure, the arms and hands forming the chair-arms. The seat lifts and toys may be stowed in the chair, while shirred cretonne pockets, which look just like Mr. Pickwick's own coat pockets, hang down at each side to hold toys. The toy table is long and narrow. Its top can be lifted up.

Writing on Coated Book Paper with a Fork

MOST persons are surprised to learn that an ordinary silver fork and other metal forms write on coated book paper almost as clearly and easily as the lead pencil. This action is not chemical but mechanical, though some scientists argue strongly in favor of chemical action.

Coated book-papers are treated with a substance that may be readily rubbed off; or the position of the particles of the substance may be so changed in their relation to the surroundings that they do not reflect the light.

Thus they give the part so changed by the metal a black appearance, similar to that of lead. Upon examining the writing under a microscope it is impossible to find any particles of the metal that have been rubbed off, or any evidence that the paper itself has undergone any chemical change.



A silver fork or other metal point does as well as a pencil on this paper

Platinum also marks the paper. This is proof positive that the action is mechanical, because platinum resists all chemicals except nitric and hydrochloric acids mixed (aqua regia).

Millionaire Vagabonds of Florida's Waters

The American millionaire finds a substitute for his trip to Europe

By A. M. Jungmann

The houseboat of a millionaire is really a kind of luxurious river steamer. This one is a one hundred and thirty-foot craft which can carry two thousand five hundred gallons of gasoline

WHEN we wish to think in the superlative of luxury, our minds, curiously enough, hark back to the glories of the ancients—Nero fiddling to the accompaniment of burning Rome; Cleopatra wooing Mark Antony as they drifted down the Nile in her slave-driven silk-hung barge. Yet it is safe to assume that the most gorgeous queen of history would have paled with envy could she have compared her barge with that new toy of wealthy America—the power houseboat. Yet these same houseboats may not be such an extravagance as they seem. It may be cheaper to move than to pay rent or taxes, when you can afford to live in a floating palace. A few years ago the general conception of a houseboat was a square, rather ugly structure, mounted on a number of barrels lashed together. Today the modern houseboat is a sort of glorified combination of a Fifth Avenue mansion and the latest cry in steam yachts.

Since the war broke out in Europe, many of our wealthy pleasure-seekers have been forced to forego their annual European pilgrimage. Our own resorts, especially in the South, do not afford the luxurious accommodations that the American millionaire has been accustomed to obtain on the other side. And so the war was followed by a boom in power-houseboat building. Larger than ever is the fleet of these boats that has gone to Florida this winter. Most of them are equipped with gasoline engines which enable them to make the trip under their own power.

The houseboat of a millionaire is really a kind of luxurious river steamer. She may be anywhere from fifty to one hundred and fifty feet in length, and she may accommodate from ten to forty wealthy vagabonds, depending on her size.

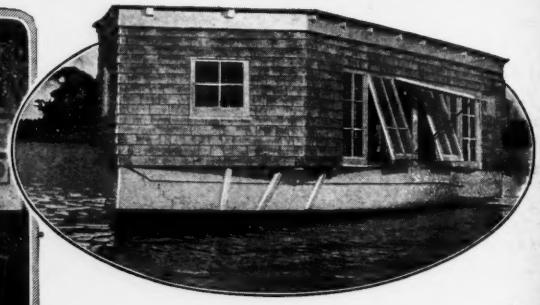
Do not confuse the houseboat with a yacht. A houseboat is not so much a ship as a home. Her living and dining rooms are commodious and bright. A number of the staterooms are sure to have private bathrooms, with all the requirements of vanity.

Such a boat is lighted by electricity. She has a hot-water plant, a ventilating plant and an excellent refrigerating system. The fish caught by the guests are kept absolutely fresh in a special tank supplied with fresh sea water. Of course the guests want to talk to one another without screaming down the corridors, and so a telephone system is usually considered indispensable. Besides there is an alarm system, to be used in case of fire or accident, an electric bilge pump and a complete fire fighting apparatus.

A big houseboat, a one hundred and thirty footer, will carry 2500 gallons of gasoline, for which a type of tank has been devised with filling and vent pipe so arranged that no gasoline will get below deck when the tank is filled. Her large refrigerator will carry 7000 pounds of ice. Storerooms, pantries and lockers are so big and numerous that she can carry supplies enough for months. If her owner desires to escape civilization, all he has to do is to sail away for a year and a day and have all the comforts of life without any of the modern inconveniences.

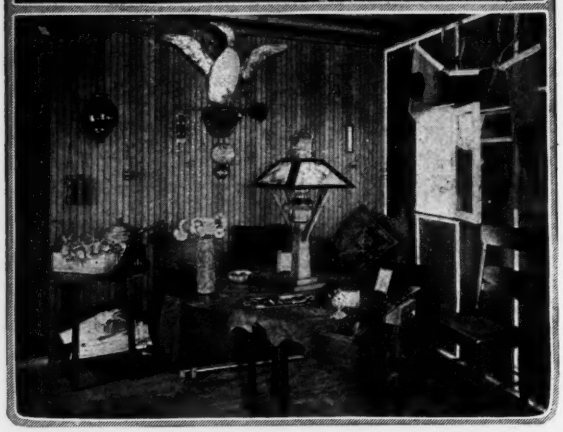
There are numbers of these houseboats which have gone to Florida this winter. Some are wonderfully complete and comfortable though only half the size of others. All are able to travel under their own power. The majority have gasoline motors.

The Styles in Our Modern Houseboats Run the Gamut



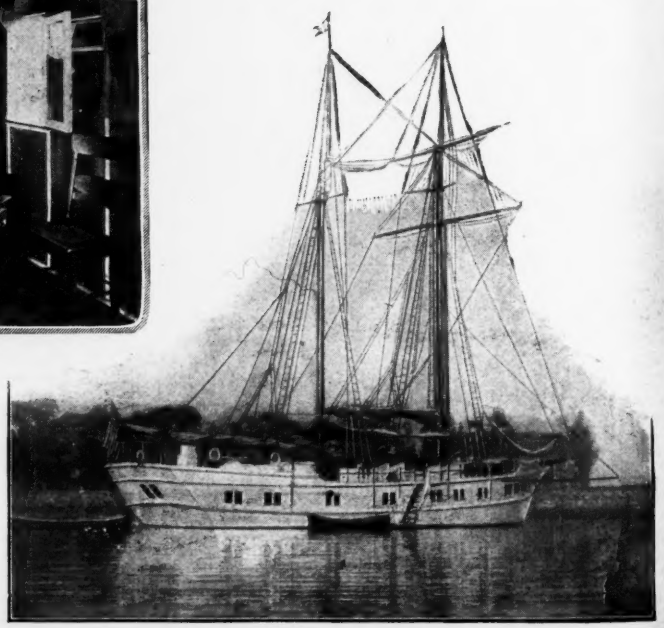
Above: A modern bungalow type of houseboat, in which the only economy is that of space. It is furnished in the same style as if it stood on solid earth

At left above: Some city apartments are smaller than the dining-room alone on this commodious houseboat. There are even fresh flowers for decoration

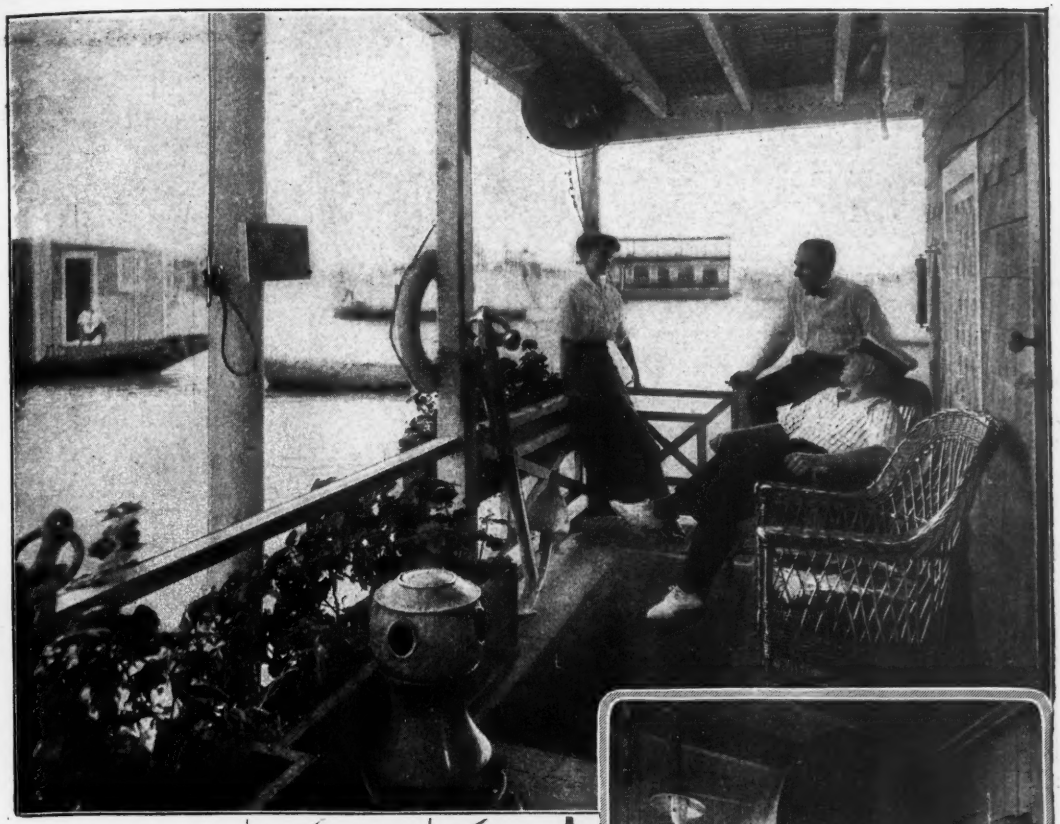


At left: This bedroom is an actual photograph of the supplanter of the seaman's berth. There is nothing suggestive of a ship's furnishings anywhere in the room

Below: A sailing vessel which has been converted into a luxurious houseboat. The majority of these boats, however, depend on gasoline, not on the wind



Above: There is solid comfort in the living-room which is modeled after the "den" at home. Note the high ceiling and the many little details which speak of personal ease and enjoyment. The sunlight streams into this room not through a porthole but through a real window



At top above: The millionaire vagabonds may desire to escape civilization but they can't get along without their luxuries. The verandas of the houseboats are not planned with regard to high seas; they are equipped with lavish furnishings and the owners hope for unvarying calm

At left above: A member of the larger family of houseboats which has all the modern conveniences of sailing. A houseboat of this size carries storerooms, pantries, lockers and supplies enough for months of wandering far away from civilization

At right above: The kitchen of the luxurious power houseboat is as completely equipped as that of a modern restaurant. Two stoves are shown, one an oil stove and the other for coal

Eternal Vigilance on the Part of One Hundred Food Inspectors

Photos Amer. Press Assoc.

To protect New York city's four millions against food contamination the Department of Health employs a corps of one hundred inspectors. The photograph above shows an inspector condemning a quantity of pineapples after pouring crude carbolic acid over them to prevent them from being used

Above: Smelling separate pails of yolks and whites of eggs to detect mustiness and sourness. The eggs are later mixed and frozen in thirty-pound tins for use of bakers and confectioners

At left: Carcass of forehalf of beef condemned by a veterinary as tubercular. An inspector is spoiling it with carbolic acid, after which it will be destroyed

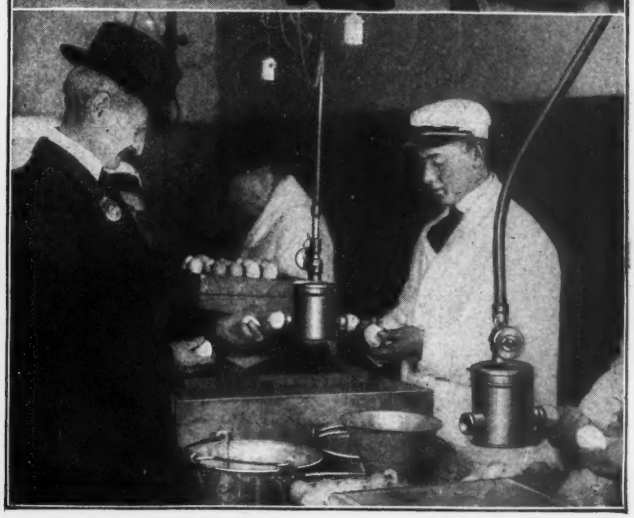
Is the Price Which New York City Pays for Food Safety

Inspectors ruining a barrel of spoiled fowl with kerosene oil before the owner could place it in cold storage. All rotten meat is removed and shipped to Barren Island. Here it is converted into fertilizer

Below: Examining a dough-mixing machine in a bakery. Bakeries in the tenement districts require constant watching. But thanks to modern machinery, conditions are better than they ever were before

At right at bottom of the page: Inspector examining "candled out" eggs to detect "too close" candling, which means that eggs with only a few slight spots have not been eliminated from among the sound eggs

Below: Passing on German carp. The gills must be a bright but natural red to assure the inspector that they are fresh and unpainted. Fraudulent dealers used to paint the gills with a carmine solution



The upper tray slides on the sustaining rods so that it extends over the bed to just the desired location. The lower one is stationery

A Double-Decked Serving Tray for the Sick Room

A NEW wheeled serving-tray has been devised by John J. Moore, of Batavia, New York, for dining-room and hospital service. It is especially useful in the sick room, as the upper tray member may be extended to one side over the bed on which the patient who is to be fed from it is reclining.

In hospital service the superposed trays are especially useful for segregating medicinal preparations and the like from surgical instruments, bandages, etc., and thus reducing time and labor incident to many separate operations. Moreover, the supporting frame of the trays may be quickly elevated or partially collapsed whenever desired.

Although one's first thought is of the sick and convalescent when an invention like this is brought to the attention, it must be admitted that there are times when the well and hearty are appreciative of a breakfast served in bed. The serving tray could be "laid" attractively and the coffee pot and covered dishes kept piping hot on the tray below.

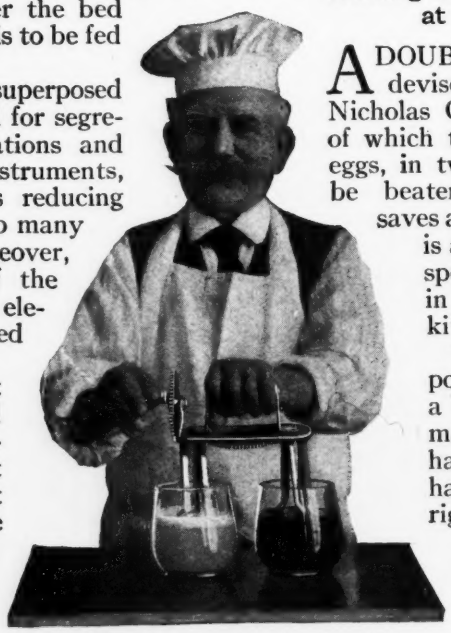
Truth Crushed to Earth Will Rise Again But a Lie Can't Be Crushed At All

IF you have noticed the big wooden clocks that are hung as shingles outside jewelers' windows, you will have noticed that they point generally to 8:18. The story has often been told that the patriotic sign painters paint the hands in this position for the purpose of commemorating the time of President Lincoln's assassination. But—as the Three Wise Men would say—don't believe everything you hear. This has recently been investigated by some interested men with the result that the story, patriotic though it is, could not possibly be true. In the first place, Abraham Lincoln was shot over an hour later than 8:18. But more than this, jewelers' clocks were pointing out 8:18 twenty-five years before that unfortunate night in April, 1865. They were placed in that position to give the greatest possible space for the jewelers' names and for their advertisements. Finally it was found out that the story itself was merely a "frame up" by two newspaper men who thought they would test a pet theory of theirs—that a plausible lie, when once in circulation, will continue to go on forever.

Beating the Yolks and Whites at the Same Time

A DOUBLE egg-beater has been devised by a Seattle man—Nicholas Condogeorge—by means of which the whites and yolks of eggs, in two separate bowls, may be beaten simultaneously. This saves a great deal of time, and is an advantage which is of special importance to cooks in hotels and restaurant kitchens.

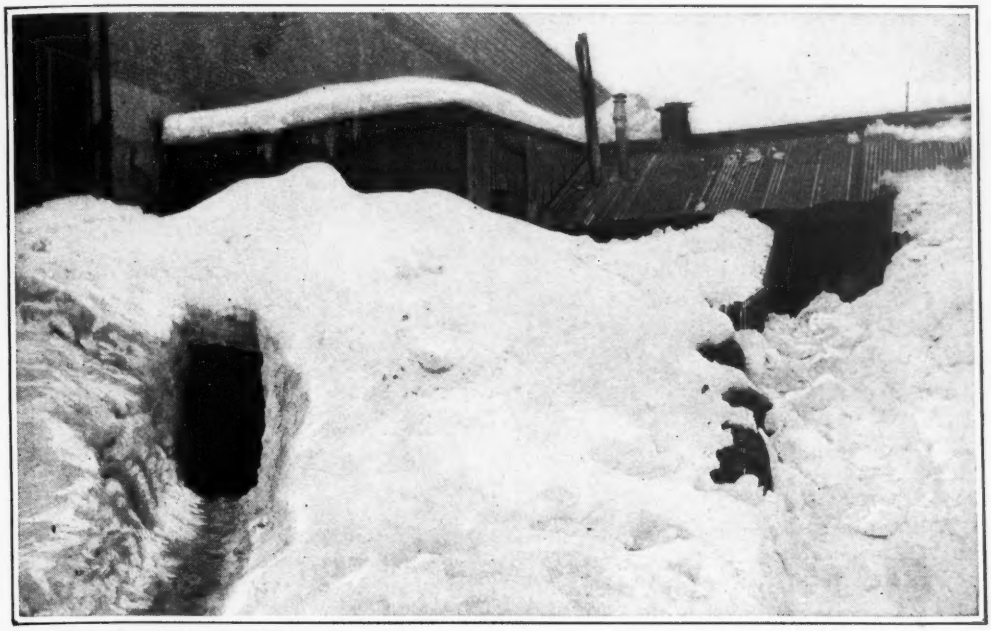
The two beaters are supported from a frame having a U-shaped handle which may be grasped by the left hand, while the beating handle is rotated with the right hand. The beating handle or crank is attached to a vertical gear wheel that meshes with a gear attached to one of the beaters. This gear in turn meshes with other gears that drive the companion beater simultaneously.



The yolks are in one bowl; the whites in the other. Turn the crank and you beat both at once in record time

Snow: A Curse and a Blessing

The same blanket of snow in high mountains that sends destructive avalanches down into the valleys will serve to feed irrigation streams in the spring and make agriculture possible



The heaviest snowfall in the whole country, as far as known, occurs in the high Sierra Nevada, of California, where the houses are often buried up to their eaves. This snow, melting, furnishes most of the water for irrigation in the California lowlands

IF snow were only a thing for children to romp in and poets to prate about, the United States Government would probably not be minded to publish throughout each winter a weekly snow bulletin, comprising telegraphic reports from all parts of the country, nor would it send out its experts to probe and map the mountain snowfields for the purpose of determining the probable water-supply from this source.

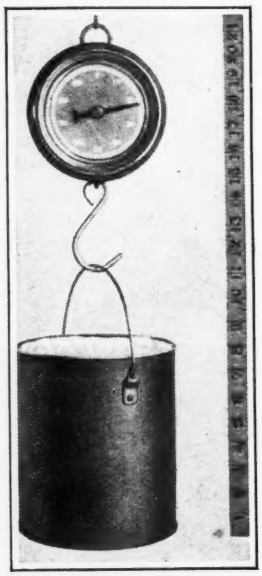
A good snowfall chart of the United States will show you that, in a normal winter, the total amount of snow falling in various parts of the country ranges from *nil* in southern Florida and parts of California to more than one hundred inches in northern Maine and on the southern shores of Lake Superior, and to three hundred or four hundred inches in portions of the Rocky Mountains and the Sierra Nevada.

The occasional heavy fall of snow presents a problem to the street-cleaning authorities in our great cities that is not yet fully solved. Only a few years ago the uniform method of dealing with this problem was to wait until the storm was over and business effectually tied up; then press into service as many men and wagons as possible, and gradually dig the city out.

The tendency now is to begin work as soon as the snow has covered the pavements if the indications point to a continuance of the storm. A most important advance consists in a recognition of the extent to which the sewers can be utilized in snow removal. While some authorities advocate flushing the snow into sewers with a hose, the method which has recently proved successful in New York City is to collect it in wagons and dump it into the manholes, under proper supervision to prevent an unnecessary amount of solid matter from being dumped along with it. Two cubic yards a minute can be shoveled into a twenty-four-inch manhole, and, under ordinary conditions, it is found that the entire amount is melted within three hundred feet of the manhole by the relatively warm water in the sewer. The cost is a small fraction of that entailed by the old method of hauling to riverside dumps.

Removing Snow from City Streets

Several devices for melting snow on the streets have been introduced or suggested, but, except for cleaning sidewalks, they have not come into practical use. One plan is to flush the streets with hot water. A special car, equipped with steam pipes for melting snow, has been successfully used by the Pennsylvania Railroad in its yards at Philadelphia, and a similar device would probably be suitable for municipal use. The snow is shoveled into a shallow receiver in the upper part of the car, where it is immediately melted by the steam. The lower part of the car forms a tank in which the water accumulates, and from which it is drawn off and emptied into sewers when the tank is full.



A snow sampler is a metal tube or bore which is forced down into the snow to secure a sample. When the snow is shallow a bucket is used

Many and formidable are the snow problems with which the railways have to grapple, and the solutions take the form of snow sheds, fences, ploughs of various types, flangers, gasoline torches for melting snow in switches, etc. Notwithstanding all these expedients heavy snowstorms still result in tieups or the serious demoralization of schedules.

Special warnings are issued by the Weather Bureau whenever a heavy fall of snow is in prospect. These are interesting not only to the railways, traction companies and street cleaning authorities, but also to stock-raisers on the western plains, where timely notice of an approaching snowstorm makes it possible to get the cattle in from the ranges and save them from starvation.

The Snow and Ice Bulletin which the Weather Bureau publishes weekly during the winter shows, by means of a table and chart, the depth of snow on the ground at a great number of places throughout the country, and also contains a review of the snow conditions of the preceding week. This is of value to the railways, shippers, and everybody interested in crops subject to winter-killing, especially winter wheat.

How Snowfalls Are Measured

One of the most interesting snow problems—and one that has attracted much attention in recent years—relates to the measurement of snowfall in the mountainous regions of the west from which comes most of the water used for irrigation in the adjacent lowlands. The mountains not only receive much more snowfall than the lowlands, but they retain it much longer. Thus a mountain constitutes a snow reservoir, which feeds the water reservoir constructed by the irrigation engineer.

In connection with the reclamation projects it is important to know how much snow falls, from year to year and also on an average, over the watersheds from which irrigation water is supplied. The Weather Bureau has accordingly established, in

Stock-raisers throughout the west and northwest are severe sufferers from snowstorms. Special warnings are sent to them

addition to its regular stations (located mostly in important towns), about two hundred special snowfall stations in the mountains and foothills. The Bureau has also developed special forms of measuring apparatus appropriate for such locations.

The relation of the depth of snow to its water content is quite variable. It has been customary, when more exact determinations were impracticable, to regard ten inches of snow as equivalent to one inch of rainfall, but this assumption is only correct for snow of average density. In problems of water-supply the depth of snow is of no consequence in comparison with the water content, and the latter can be obtained either by melting the snow before measurement, or by weighing the snow. The latter process is generally much simpler and is the one utilized in the type of gage used by the Weather Bureau at its mountain stations.

The Marvin gage for measuring rain or snow. At the top is a trumpet-shaped wind-shield and in the middle a cylindrical can, or collector into which the precipitation falls

The Latest Fashion in Snow-Measurers

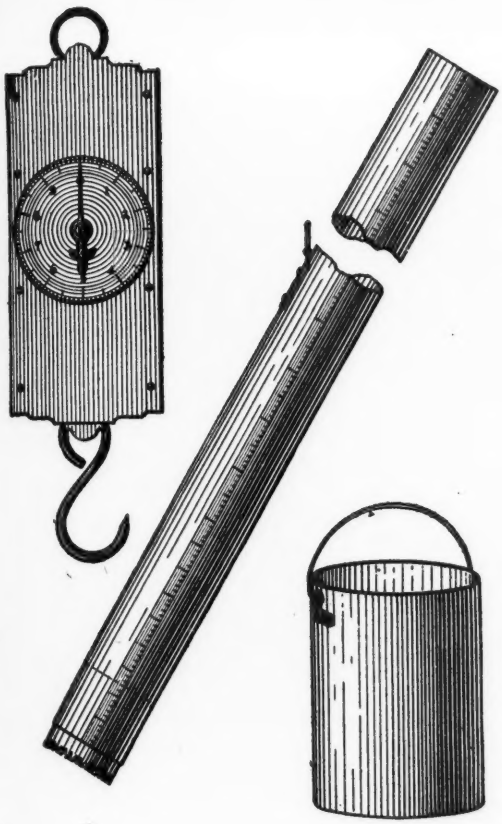
The accompanying picture shows a gage recently designed by Professor Marvin, Chief of the Weather Bureau, suitable for measuring either rain or snow. At the top is seen a trumpet-shaped wind-shield, and in the middle the cylindrical can or collector into which the precipitation falls. The can rests upon a central support, which can be raised or lowered for placing or removing the collector. In making an observation, the can and its contents are removed and weighed by means of a spring balance, graduated to give the rainfall directly in inches and hundredths. The type of gage here shown is used for daily observations, but a modified form, with much enlarged collector, is used where observations can only be made at long intervals—in some cases only once a season. In this gage oil films are sometimes used to prevent evaporation.

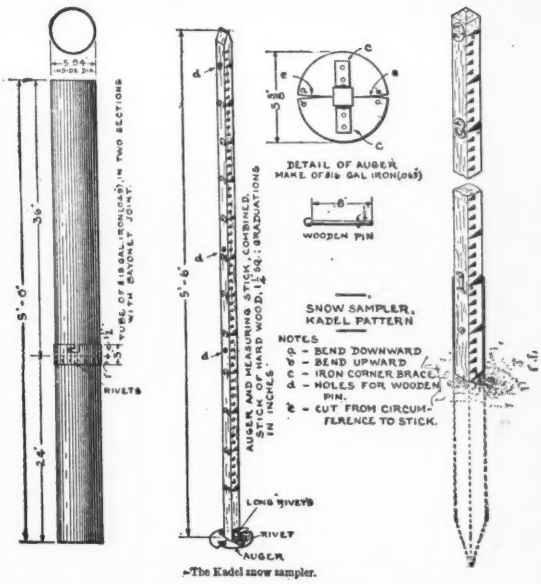
Besides snow gages the Bureau uses snow stakes for measuring the depth of snow at various points around the station. The latest form of snow stake consists of a heavy cypress stick of square section, painted white to minimize radiation effects, and bearing on one of its faces a scale of enameled iron, graduated in inches. In the picture of the measuring stick on page 229 the numbers attached to the scale represent *tens* of inches; 1 means 10 inches; 2, 20 inches; etc. These graduations can be read at a distance by means of binoculars or a telescope. The stakes are permanently installed in appropriate locations.

Lastly, the ambitious attempt has been made in recent years to ascertain, early each spring, the total amount of water available in the form of snow over wild mountainous tracts adjacent to certain irrigation projects and remote from the fixed stations. "Snow surveys" of this sort were first carried out by Professor Church, of the University of Nevada, in the Sierra Nevada, and by Messrs. Thiessen and Alter, of the United States Weather Bureau, in the mountainous districts of Utah.

Whole Districts Buried Under Snow

In the region adjacent to the line of the Southern Pacific Railway connecting Sacramento, Cal., with Reno, Nev., there are places where more than five hundred inches of snow fall in an average season. The local effects of such enormous blankets of snow are striking. Houses are often completely hidden. The problem of the railway company is graphically shown in the center oval





The Kadel snow sampler.

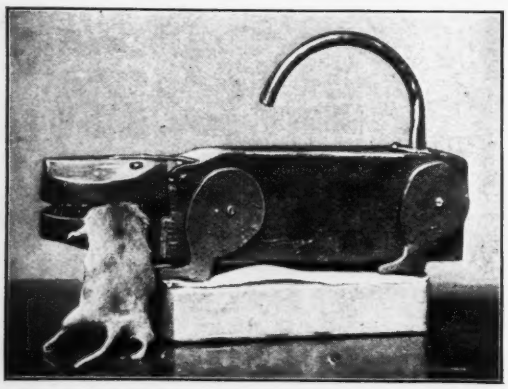
Above is the Kadel snow sampler which is an auger and measuring stick combined. The diameter of the tube is such that one pound of snow represents one inch of water

At left: The Marvin sampler. One end of the tube has a toothed cutting edge so that it can be forced through icy incrustations in the snow beds. It is graduated in inches

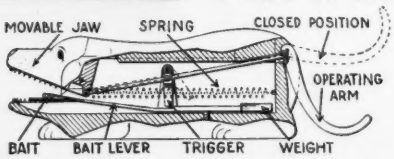
Scientists on Snowshoes

The snow surveyors travel rapidly over the watershed, often on skiis or snowshoes, carrying with them a "snow sampler" and a small spring balance. The sampler is a metal tube, of small bore, which is forced down to the bottom of the snow in order to secure a sample. The Marvin sampler, used by the Weather Bureau, is two and three-fourths inches in diameter and comes in various lengths. One end is armed with a serrated cutting edge, so that it can be forced through icy incrustations, or ice itself in the snow beds. The tube is graduated in inches. When the tube is withdrawn the section of snow remains in it, and the whole is weighed by means of the balance. Several hundreds of measurements are made on different parts of the watershed. An alternative plan, suitable for shallow beds of snow, is to shovel the snow into a bucket and weigh the latter with its contents. These methods depend upon the fact that a given weight of snow represents a definite amount of water, whereas the relation between depth of snow and water content is widely variable.

Mr. B. C. Kadel, of the Weather Bureau, has recently devised a snow sampler having a bore of nearly six inches, which is much larger than in the Marvin instrument; it is provided with an auger, which, when screwed to the base of the tube, constitutes a bottom for retaining the snow. The diameter of the tube is such that one pound of snow represents one inch of water. This ingenious instrument unfortunately labors under the disadvantage of being too heavy to be readily portable over the mountains and in districts where the transportation facilities are likely to be cut off entirely during the very time when the snow sampler is needed. There are places in the mountains where more than five hundred inches of snow falls during an average season, and where the exceptional depth is nearly eight hundred inches or more than sixty-five feet. This is in the Sierra Nevada, of California, in the region adjacent to the line of the Southern Pacific Railway connecting Sacramento, Cal., with Reno, Nev. The railway company is kept busy shoveling the accumulations off its thirty-two miles of snow-sheds.



Tails are more than mere adornments. This one, for instance, serves the purpose of setting the trap jaws of the imitation dog



Dachshund Charlie. He Eats 'Em Alive

A WESTERN inventor, Edwin S. Cunningham, of Mansfield, Ill., has devised a trap which, for originality of structure if nothing else, deserves mention. He has constructed a wooden figure of a dog (with the tail changed it would make a realistic-looking alligator) and has placed within the interior of the humble canine, a strong rat-trap mechanism.

Although the tail appears to serve only as an adornment it is really the most important part of the trap. By moving it down the trap is set. When the mouse steps on the bait-plate, which takes the place of the dog's tongue, the upper part of the jaw comes down with a thud and the tail goes up. A strong spring operates it.

Standardizing Our Automobile Shop Language

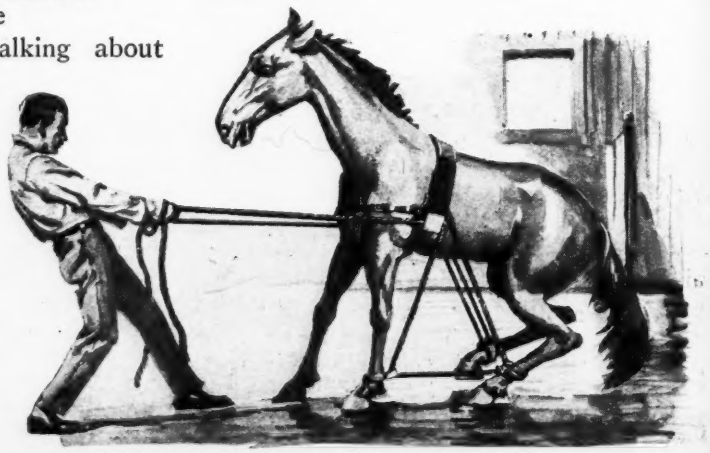
HEREAFTER people talking about their automobiles will be able to understand each other. A nut will be called a nut and a bolt a bolt. When repairs and replacements are ordered, manufacturers will not need to spend the better part of the day figuring out just what part of the automobile's intricate anatomy is wanted. In other words, the present chaotic condition of automobile nomenclature is about to be remedied. The Society of Automobile Engineers proposes that there be a list of uniform names for automobile parts and that these names be standardized. To this end the society has published a report on automobile terminology. The automobile is dissected into nineteen general divisions, and all the parts in each division are given their standard names—making a total of nearly seven hundred names of separate parts. But the work is not yet completed. There are several groups still under consideration.

The name "engine," notes the report, should be used rather than "motor," to avoid confusion with electric motors and to secure a lower freight rate. Thus it will be "engine-car" instead of "motor-car."

Don't Throw a Horse. Make Him Lie Down if it's Necessary

VETERINARY surgeons frequently have to throw a horse to perform an operation. As there is danger of hurting the animal, specially devised shackles are sometimes used, one form of which, shown in the illustration, seems to be especially humane and is very easy of operation.

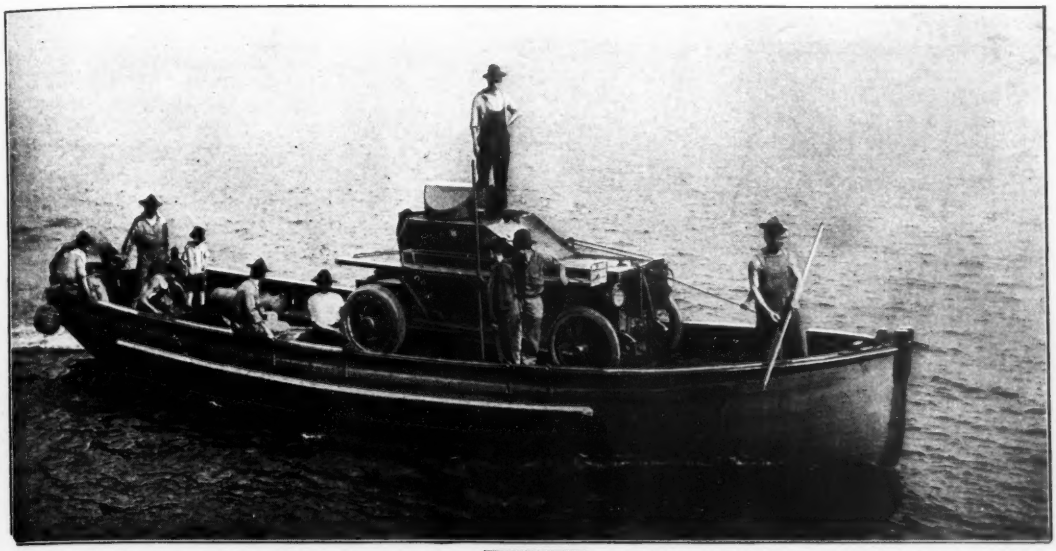
The arrangement is such that a pull on the forward ropes will draw together a front and rear foot and tend to raise both rear feet from the ground, causing the horse to lie down. The same thing can be accomplished by hitching the front ropes and making the horse step backward. One leg is left free to aid the animal in assuming a prostrate position without injury or undue strain.



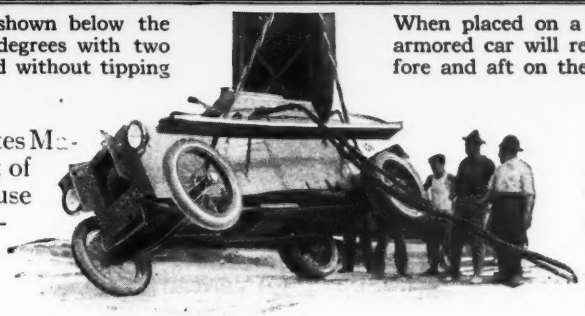
With this device only three of the animal's legs are shackled, one being left free to enable him to lie down rather than fall

An Armored Motor-Car for the Navy

It is manned by a crew of three and equipped with searchlights and machine guns



In the tipping test shown below the car stood at thirty degrees with two wheels off the ground without tipping



When placed on a sailing launch the armored car will rest on joists placed fore and aft on the thwarts as shown

THE United States Marine Corps, first of our services to use motor-trucks in warfare, will be equipped with armored motor turret-cars for its use in tropical expeditions. The turret-car weighs five thousand pounds, travels forty-seven miles an hour, and carries a crew of three men. It has wire-cutters for road obstacles, searchlights for night fighting, and machine-guns. The armor, sloping at forty-five degrees, will stop the bullet fired from a service rifle at one hundred feet. The turret has four gunports, allowing fire in any direction.

This armored car will be carried aboard ship. When lowered into a motor sailer or sailing launch it will rest on joists placed fore and aft on the thwarts. The boat is beached stern first and the car is run ashore in fair weather over planks hooking on to the stern, or in bad weather by shear legs and a multiple block.

In the tests the car took ditches and plowed fields and ran hub deep in sand. When tipped by use of a ship's crane the car stood at 30 degrees, with two wheels off the ground without tipping. The uses to which it may be put are obvious.

The Rubber Stamp Has Many Uses, Good and Bad

IT is not contended that the rubber stamp is exactly on the same plane of importance as the rubber tire, but in value of annual product these two commodities stand in about the ratio of fifty to one. The car owner's annual contribution aggregates approximately $200,000,000. That of the stamp user is about $4,000,000.

But in one particular the stamp far surpasses the tire—in number.

There are 12,000,000 tires in use in the United States to-day, while of rubber stamps there are 100,000,000.

The rubber stamp does its work faithfully and cheerfully. In fact it has become recognized as a symbol of unquestioning obedience, and one statesman will charge another with being a "rubber stamp" in fealty to an opponent.

The Wireless Detective

How transgressors of national and international Radio laws are caught

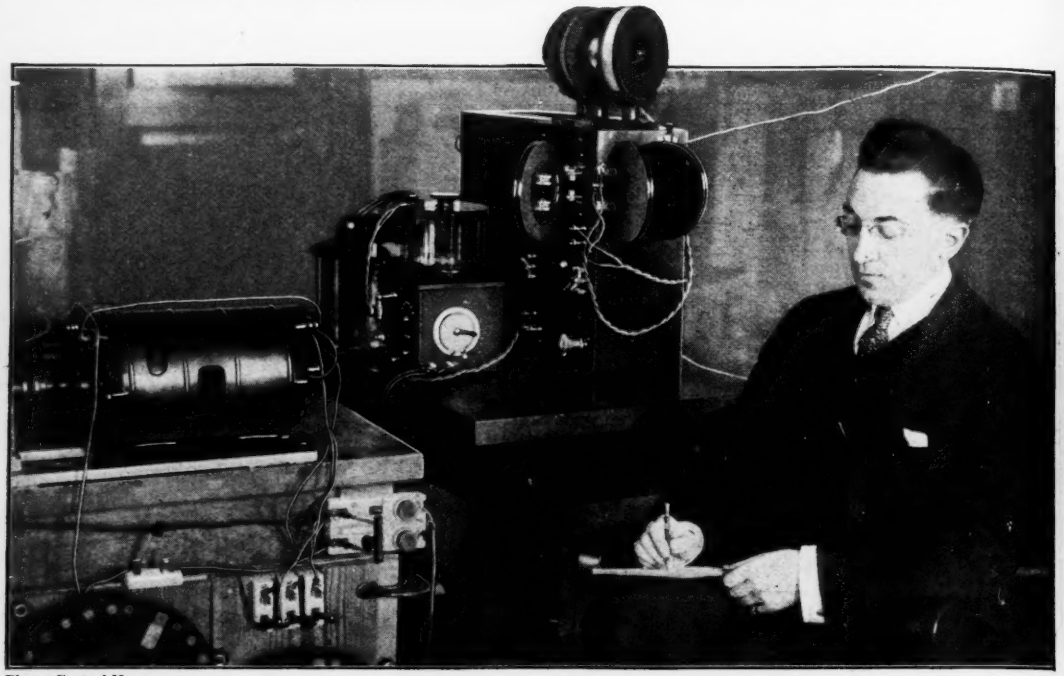


Photo. Central News

A "Radio Detective" which not only picks up passing wireless messages but also determines the direction from which they come and the probable location of the sender

EVEN in times of peace it is often of importance to locate wireless sending stations. When an amateur's station is transgressing national law, or a spying government's station is transgressing international law, a "radio detective" will be of valuable assistance to our government. But in time of war, an instrument that can not only intercept wireless messages but can also locate the senders, will be of great strategical importance.

The photograph above shows such an instrument which has been brought out by Frederic Koester, a young experimenter in the United States Bureau of Standards, of the Department of Commerce. The apparatus picks up the passing radio messages and, at the same time, indicates the direction from which they come. By listening to the same message with two instruments of this kind placed at two different points, the position of the sender may be definitely determined. It is necessary only to mark on a map the two positions where the instruments are receiving the message and to draw two straight lines in the directions shown by them. The place where the two lines cross on the map will indicate the desired spot.

Motion-Pictures Tell South Americans of Our Industrial Development

TO acquaint South Americans with the industrial development of this country and particularly to educate them in typical American manufacturing processes, welfare work in industrial institutions, and other details of economic life, the commercial attaches in the Latin-American countries are exhibiting motion pictures in their respective localities.

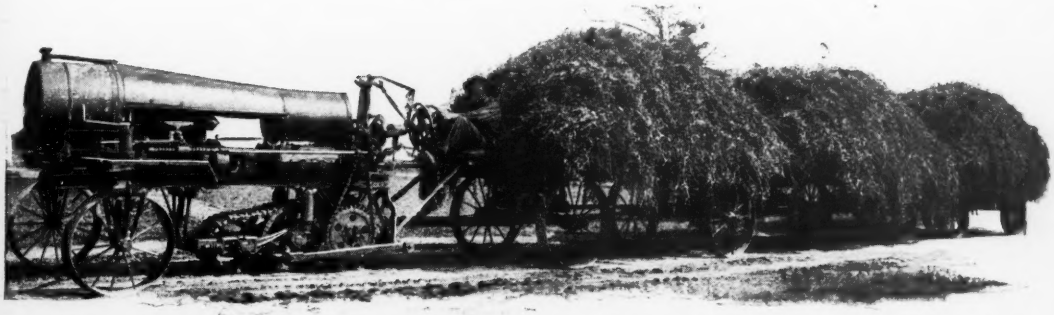
The pictures are being given under the auspices of the Bureau of Foreign and Domestic Commerce, but the films are obtained through the Bureau of Commercial Economics, an unofficial organization with headquarters in Washington, which has on hand a large number of films showing various phases of American industry. The films which the Bureau thinks most desirable are sent to the commercial attaches.

In addition to educating the South Americans along American industrial lines, one purpose of sending the films is to stimulate interest in a much more extended campaign by which American manufacturers may have their films displayed for advertising purposes.

Wall Street Goes a-Farming

Raising crops on the factory plan with four thousand hired men

By John R. Colter



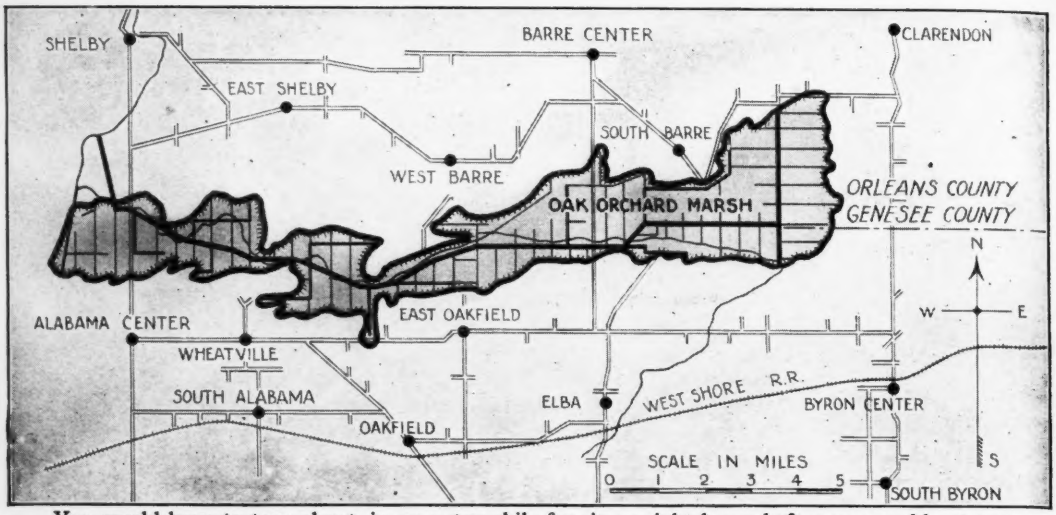
Getting teamsters is a chronic difficulty on a farm. The "steel mule," or tractor solves this problem for "big business." Above is shown one of these "mules" hauling pea vines to a threshing station

WHEN Capital undertakes anything, whether it be an exploitation of a mine, a mill, a chain of grocery shops or a transportation project involving a string of railroads—you expect scientific treatment, efficient management, and a certain daring grappling with problems never before solved. In tackling its latest important development job—the growing of things in the ground—Capital has not gone about the work in any less thorough or scientific manner. The gigantic Oak Orchard Farm, largest of muck-gardens in the Eastern states and possibly in the whole world, stands even to-day—when it is scarcely two years old—as an admirable example of what a great farm can be when conducted under the precise and systematic management of "Big Business."

They call it the "Wall Street" farm up in Genesee County, New York, but it would not blend with what is probably your conception of a farm. You would have to tour about in one of the farm's automobiles for six or eight hours before you could get an idea of it all. It is a vast tract. It is nine miles by two miles, to speak roughly, for the general contour is that of a pair of saddle-bags. To pay off the men who work on the huge outdoor hotbed the paymaster makes a sixty-mile trip. Oak Orchard Farm has its own telephone system, its own farm-machinery repair shops, builds its own roadways, counts its cattle on a dozen sizeable hills, does its experimental seed-planting on thirty-five-acre lots instead of twenty-foot squares, swarms with labor-saving caterpillar-tractors and light steel "mules" in place of horses, plants onions and lettuce by the half-mile row—and has its own canneries, storage cellars, garages and home-communities in the bargain. A gigantic country-produce manufacturing plant with a potential acreage of eleven thousand—such is the self-sustaining undertaking with which the New York capitalists who own and operate the Oak Orchard Valley bid fair to revolutionize the business of farming.

Dynamiting Ditches to Obtain Muck Land

Three years ago the great Oak Orchard Valley which lies just north of Elba, N. Y. (half in Genesee and half in Orleans County), was a vast marsh, overgrown with dense underbrush and studded with forests of heavy timber. It was at once a lumberjack's job and a drainage engineer's job. Through the center of the marsh a colony of Adirondack lumbermen cut a path—they were specially brought down for the occasion. Behind them the engineers dynamited and dredged a ditch which would ultimately carry off the surplus water to Lake Ontario, fifty miles away. Lateral canals, feeders to the main ditch, were gouged out at distances of approximately two thousand feet. Thus the great bulk of the surface waters of the region were carried down the valley, leaving exposed several thousand acres of hitherto submerged muck-land—that superwealthy soil which produces truck-stuffs with lavish

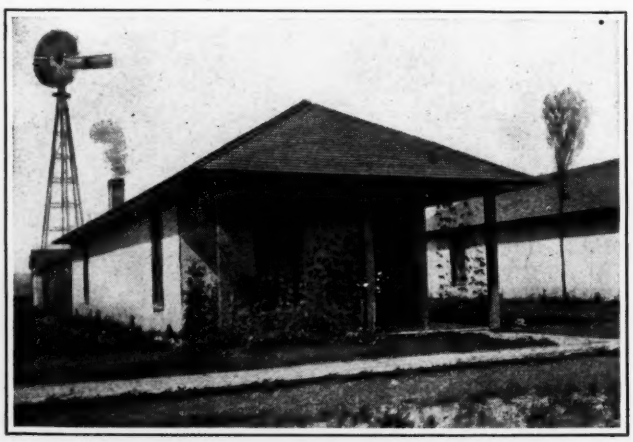


You would have to tour about in an automobile for six or eight hours before you could get any idea of this farm. It is a vast tract nine by two miles and like a pair of saddle-bags in contour

fertility. Over sixty miles of drainage canals, criss-crossing the immense farm, have been constructed, so that to-day the muck region stretches for miles in every direction. In certain parts of the valley the reclamation work was accomplished in what is undoubtedly record time. One large patch, which in the Autumn of 1913 was practically a lake bristling with heavy trees, was transformed in nine months into a harrowed field, ready for planting. Drained of water, stripped of woods, ploughed, harrowed—and a lettuce crop harvested within the following three months—that is a record of engineering and agricultural achievement which corporate farming may well boast of for a representative twelve-month's work.

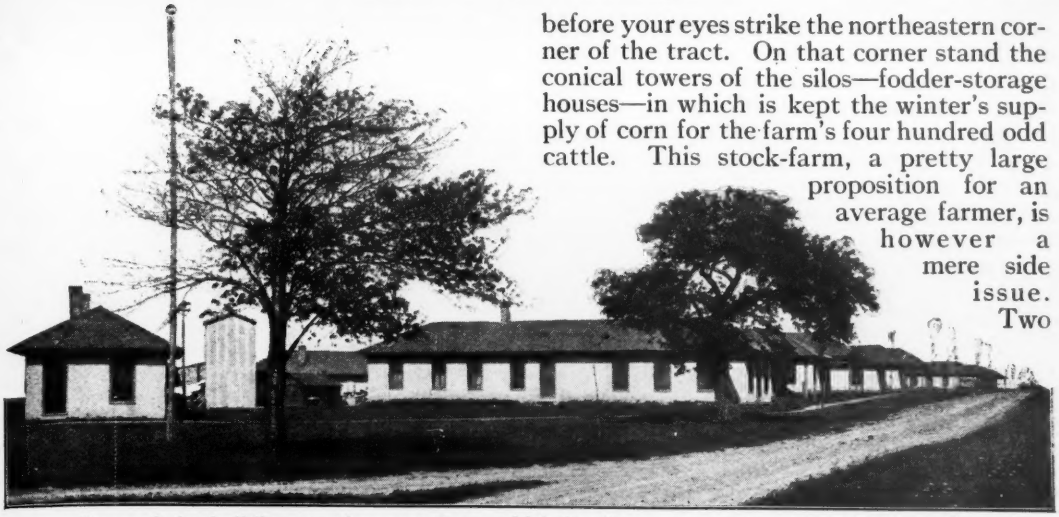
The Factory Idea Applied to Farming

But in the layout and management of the huge green-stuffs factory—that is precisely what they are making of Oak Orchard Farm—lie its most interesting phases. Every hundred-acre plot of soil receives careful planning with regard to its tillage, planting, cultivation and harvesting. The light and heavy tractors, employed instead of horses, do their work under gangs of men. There are plough-foremen, and harvesting staffs on Oak Orchard farm, and they report to their immediate superior official just the same as a city factory sub-chief would do. Each unit of the intricate farm machinery with which the big hotbed swarms receives credit for every yard of work that it does. Each acre, under a cost-accounting system, as effective as it is unique on farms, is debited on the farm auditor's book with its daily share of man-labor, horse-labor, machine-labor, fertilizer and its share, too, of the overhead expense. There is nothing inexact about the big farm's methods; it proposes to know just where it stands after the crops have been harvested and sold.



The dwelling in the home communities as planned by the farm officials is not at all the ordinary type of farmhouse; but is compact, cozy and attractive

Efficiency, especially wherever the precious muck-soil is involved, is the by-word in operating the farm. For instance, the ancient rail-fences which marked boundaries have been completely



Some of the buildings on the great farm, which has its own garages, power plant, machine shops, smithies, maintenance shops, canneries, storage cellars and home communities

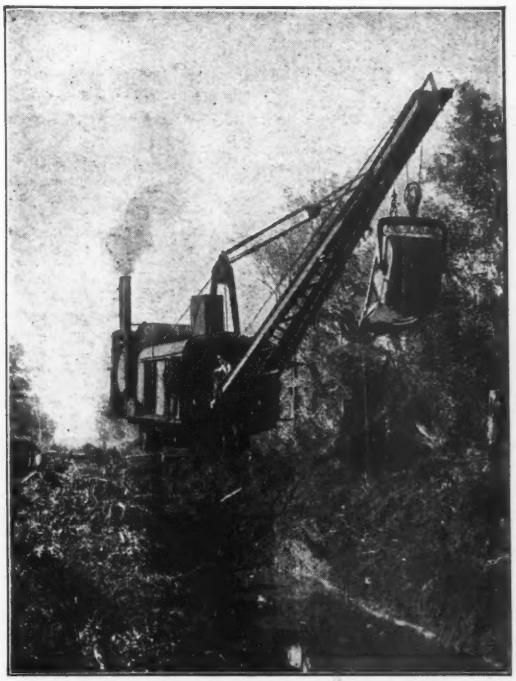
before your eyes strike the northeastern corner of the tract. On that corner stand the conical towers of the silos—fodder-storage houses—in which is kept the winter's supply of corn for the farm's four hundred odd cattle. This stock-farm, a pretty large proposition for an average farmer, is however a mere side issue. Two miles to the south lie a group of apple orchards on the sloping uplands that surround the muck. Various orchard gangs, under trained foremen, run miniature water-tower machines down between the rows of trees, spraying with insecticides. It is but an instance of the minute care given every wisp of plant life on the big farm. Daily reports on the condition of each orchard, each onion

discarded. It would waste a strip of muck at least a foot wide, they reasoned—and they would need such lengthy fences on the big farm that the aggregate loss of tillable soil would be enormous. When it came to the labor problem and the horse-feed problem, the officials did not hesitate to blaze a new trail in farm-operating annals. Of course all modern farms have a few tractors, but this corporate farm has them by the dozen. Not only does the "steel mule"—light tractor—save in operation over the heavy-eating Dobbin—it saves the employers from the ever present (on the ordinary farm) "hired man" problem.

"We find that the young fellows of the community just love to handle a 'mule' and learn to take care of its mechanism. There's something Twentieth Century about this way of ploughing, harrowing and general farm hauling that does not seem irksome. No labor problem because of discontent on this farm," the officials say. "Getting teamsters is a chronic difficulty on farms; we use 'steel mules' and other tractors—and find no trouble at all. Electric light, running water, phonographs, clubhouses, telephones, steam-heat and billiard tables in our farm-hand dormitories—we count these scientific ways of helping to solve the farm labor problem, too." Which is sound efficiency.

A Farm Measured by Miles

Stand on the hill where the headquarters camp is located, on the southern side of the big farm, and you can look for three miles over a level expanse of coal-black muck



How the drainage canals were dug. With the completion of each mile of dredged ditch, immense acreages of submerged muck lands of great fertility were released for tillage

patch, each seed-planting experimental plot go to the central office of the farm. It is a corporation tradition that system shall be sovereign — and it is in Oak Orchard Valley.

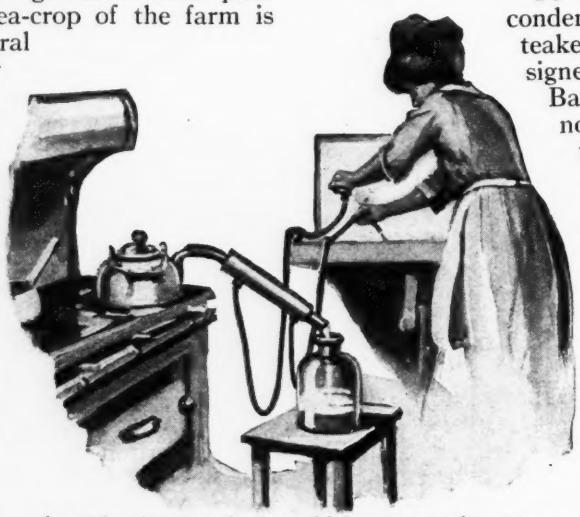
Naturally the new order of tilling—the widespread use of the caterpillar tractor and the "mule"—has brought about a new order of barns. Oak Orchard maintains its own machine-shops, lathes, smithies, gasoline stores and maintenance-shops. The old-style rambling barn does not exist. Nor do they thresh their grains or their peas in a shed. The pea-crop of the farm is so large that several different pea-viner stations have been established. The vines are hauled to the various stations and put through special pea-threshing machines, the peas falling into tin drawers which are rapidly hauled by "steel mules" over to the canning factory which lies three miles from the muck-region—on the railroad track. The same principle of specialization for the purposes of efficiency has led to the construction of a uniquely designed building known as the "Ordinary Storage Cellar." It is intended for Oak Orchard's immense root crops, such as potatoes and carrots, and serves to keep the vegetables in perfect condition until such time as the market is high enough to assure a good profit.

One of the hardest of unusual problems that the big farm has had to cope with is that of wind control. After experimentation a large number of light, temporary fences—split-open fertilizer sacks strung on wires which in turn were supported by light wooden posts—were erected at intervals of two hundred and fifty feet. This form of windbreak, although extremely cheap and very easily erected and removed, has proved very effective.

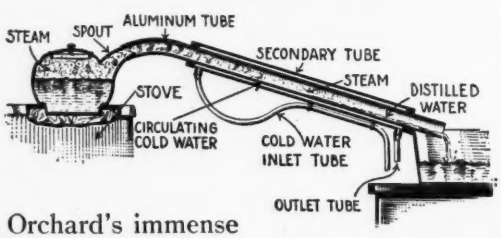
A Simple Teakettle Attachment for Condensing Water

THE drinking water found in many places is unfit for use because of the presence of foreign substances such as clay and earth in suspension, salts of various kinds in solution, and innumerable organic bodies which cause sickness and disease. To purify such water by filtering is both expensive and unsatisfactory. On the other hand, no apparatus is available which will distill water in an economical manner.

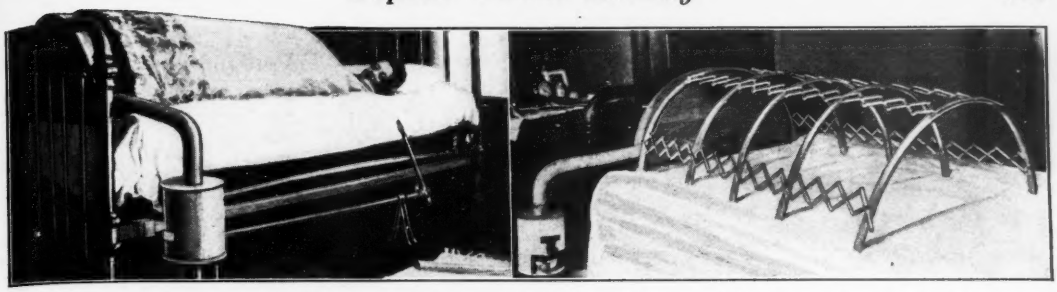
To fill such a want a condensing attachment for teakettles has been designed by Eugene N. Baldwin, of Joliet, Illinois. It can be attached to an ordinary teakettle to condense the steam issuing from the spout and to deliver the distilled water into a suitable receptacle for use.



A condensing attachment which converts the steam issuing from the teakettle spout into distilled water and delivers it into a receptacle as shown below



The condenser consists of an aluminum tube open at both ends, with an air-tight, water-tight copper tube mounted on top and two flexible tubes and a pipe for cold water attached to the bottom. In setting up the apparatus the aluminum tube is placed over the spout of the kettle, and the flexible tube or hose is attached to the cold water faucet. The steam emerges from the spout, enters the tube and, passing down it, is condensed by contact with the walls of the tube cooled by cold running water. The condensed water flows into the receptacle where it is stored until desired for use. The distilled water may then be kept in this receptacle for a few hours. By so doing, the "flat" taste that the water has directly after being distilled will be to a large extent removed. The hardest water may be made soft and usable in this way. Of course it must be kept closely covered until used.



A framework made of wooden arches fits over the bed and is covered by an ordinary blanket or quilt. The heated air circulates over the body and is discharged through a special outlet

Taking Turkish Baths in Your Own Home

TO the person who dislikes being "fussed over" and who yet enjoys or regards as necessary the Turkish hot-air bath, a recent invention will prove interesting. It is an apparatus consisting of a framework made of wooden arches which are joined together by wooden shears. These shears make the framework collapsible and adjustable to any size desired. An ordinary bed blanket is used as a cover for the frame. Inside the frame is a heat concentrating, distributing and circulating chamber which is really a chamber within a chamber, the inner partition being separated from the outer by an air-space which prevents the outside chamber from becoming dangerously hot.

The heat is directed into the inner chamber and distributed through an upper inlet. It passes over the body of the person lying in front of it and the used air passes out through an outlet in the bottom of the chamber and is discharged through an opening in the top of the outside chamber. Thus the circulation of air over the body is complete.

The frame is light but rigid and it is easily collapsible

The source of the heat is a galvanized iron drum supported on legs which telescope to any desired height. In this drum an alcohol burner is held. The drum is connected with the heat concentrating and distributing chamber by a pipe through which the heat is directed into the outer chamber. The device can be operated and regulated by the person taking the bath.

Is Your Closet-Room Scarce? Try This Type of Wardrobe

IN the large cities it is the day of birds' nest apartments, light housekeeping and kitchenette suites, where closets are at a premium. Even in the suburbs and in the country, commodious closets are giving place to shirtwaist boxes and wardrobe trunks. However, a wardrobe has been designed by Carl A. Schlacter, of Manson, Iowa, which takes the place of a closet and may be made in such a way as to contribute to the decoration of the room in which it is used. It consists of a supporting framework which is covered, top, bottom and sides, with any desired material, such as cretonne, silk or linen, in color and design to harmonize with the other draperies or furniture of the room.

In connection with the upper part of the frame is a rod to accommodate hangers. In this way a dust-proof place is provided for hanging garments at full length. Moreover it is collapsible. The frame is easily taken down and rolled or folded up so that it may be stored away in the trunk and used on one's travels, in hotels, summer resorts, or transient stopping places.

Snap-fasteners are used to close the covering. Even the top piece is made to open up readily, so that the back of the wardrobe can be easily reached. Storekeepers and dressmakers will also appreciate this invention as a means of keeping fine dresses or finished garments protected. For such purposes the covering material should be chosen with regard to durability.

Even the Horses Must Have Their Individual Drinking Cups

WHATEVER may be the future of the horse in the commercial world, and however soon he may be displaced on the city streets by the ubiquitous automobile, his claim to good care and kindly attention will always be strong. Hence the individual drinking cups at the public fountains for horses are a natural sequence of the fight against germs which has abolished the common drinking glass for people in public places.

The ordinary drinking trough is a breeding place and distributing center for all kinds of horse-breeding germs. In many cases the fountains have been shut off, and a man has been stationed at each hydrant to give the horses water from a pail, which he cleans out with a disinfectant after each drink.

Water comes up through the bottom of the cups and keeps them constantly full and overflowing

The arrangement in the photograph is the latest and most satisfactory plan. The individual drinking cups are placed far enough apart to prevent the horses from touching each other as they drink. The water comes up through the bottom of the cups and keeps them constantly full and overflowing. The overflow is carried at once to the sewer through the openings in the large basin surrounding the cups. The constant flow prevents the water from freezing during cold weather and keeps it cool during the summer.

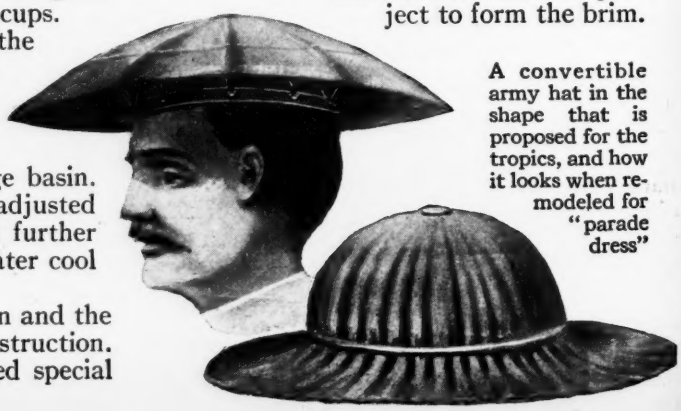
In some places wooden covers are provided to fit over the large basin. This is easily pushed aside and readjusted by the driver and serves to still further protect the cups and keep the water cool and pure.

The cups, the surrounding basin and the standard are all of concrete construction. There are no metal parts to need special attention.

Here's a New Hat Style from Mexico!

THE influences of our "scrimmages" with Mexico can be traced in many things, one of which seems to be a new idea about the way our army at the "border" might be hatted. A well-meaning Canadian proposes a new style of hat which, so he presumes, can be used as well in a Mexican desert as in a parade on Fifth Avenue. In the one case, the hat is opened so that it forms a continuous covering over a soldier's head, while in the other case, it is merely closed up so that it is converted into the more conventional brim-hat of parade dress. The beauty of the hat when it is so collapsed is, however, somewhat questionable.

The manner in which the conversion is made is nevertheless clever. When the hat is fully opened, the continuous covering is held in place by an aluminum framework which fits upon the head. When it is to be re-modeled, the ribs of the covering are merely collapsed inwardly at the hinges near their centers. Then the lower parts of the ribs are made to project to form the brim.



A convertible army hat in the shape that is proposed for the tropics, and how it looks when re-modeled for "parade dress"

How Germany Manages to Feed Her Millions

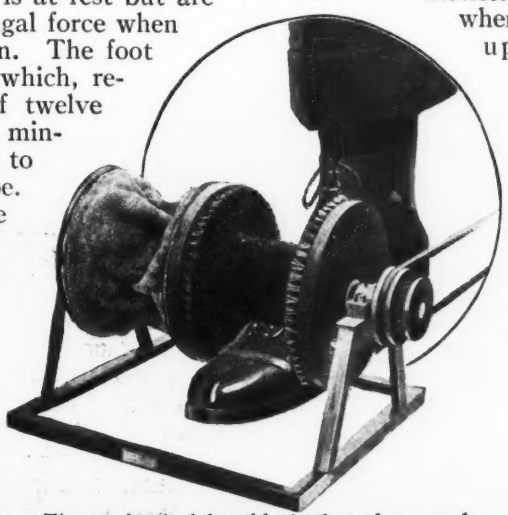
ON each one hundred acres of cultivated land, Germany feeds seventy of her people, while Britain can only support forty-five. The two chief factors in the recent remarkable development of German agriculture, are her settled economic policy and her well thought out system of agricultural education. It was the belief that he was essential to the community and that his land would not be allowed to go out of cultivation, rather than the extra profit on his wheat, that inspired the German farmer to greater efforts during the last ten years. The need for well educated men as managers of estates is more commonly recognized in Germany than in any other country in the world.

Install a Motor-Driven Bootblack in Your Home

A SIMPLE contrivance for cleaning and polishing shoes promises to save time and the price of the daily "shine" for the busy man. The machine consists of a pair of brushes mounted at the sides of a central brush, as shown in the accompanying illustration, and operated by power from any ordinary electric light socket. The blacking is applied by hand with a dauber. Then the foot is placed in the space between the two end brushes and the power turned on. The foot may be moved about in any position in the allotted space, so that all parts of the shoe may be reached.

For polishing, a flannel drum is provided, made of three or four layers of flannel which sag when the machine is at rest but are thrown out by centrifugal force when the power is turned on. The foot sinks into this drum, which, revolving at the rate of twelve hundred revolutions a minute, gives a high polish to every portion of the shoe.

The machine is the invention of a Manitoba lawyer. It is so constructed that the parts are interchangeable and easily slipped on or off, and there is nothing to get out of order or to be specially cared for. The entire operation takes up just about a minnte for each shoe.

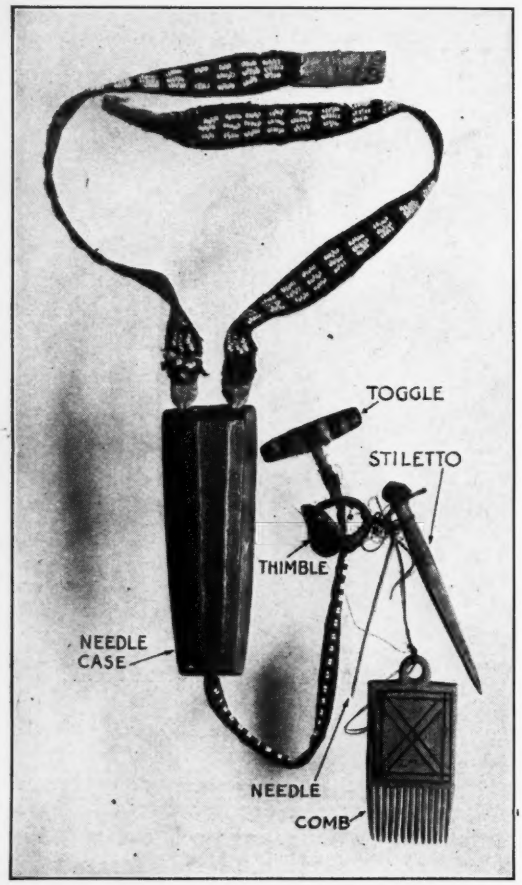


The mechanical bootblack that cleans and polishes a shoe in the twinkling of an eye

The Ferris Wheel Turned Into A Baby's Carriage

Push this miniature Ferris wheel along and the swings will work up and down

A BACKYARD can be changed into an amusement park for your children by a new type of Ferris wheel which can be pushed along wherever it is wanted. It is a combination of Ferris wheel and carriage invented by a South Carolina man, Charles M. Calhoun. The side supporting wheels are made about five feet high, and are kept in position by long iron crossbars. Two hangers are pivoted side-by-side on two special crossbars mounted near the center of the central axis of the carriage and diametrically opposite. Hence when one hanger moves upward the other moves downward, and when one is near to the rear of the carriage the other is near the front of it. In fact, the weight of one hanger always tends to balance that of the other, and very little effort is required to push the carriage along. One of the iron crossbars which hold the side wheels in place also serves as a handle by which to push it.



The sewing materials which the Eskimo women use for their elaborate needlework

The Eskimo Workbasket Which Is Worn About the Neck

THE Eskimo housewife wears her workbasket about her neck, which means that the Eskimo housewife is exceedingly industrious. During the long winter months she has nothing more to do than chew blubber and make ornaments to adorn herself and her several daughters. Some of the most elaborate needlework is done by these silent folk of the far North. Out of the toughest of hides and with the crudest of instruments they have wrought objects of great beauty and interest.

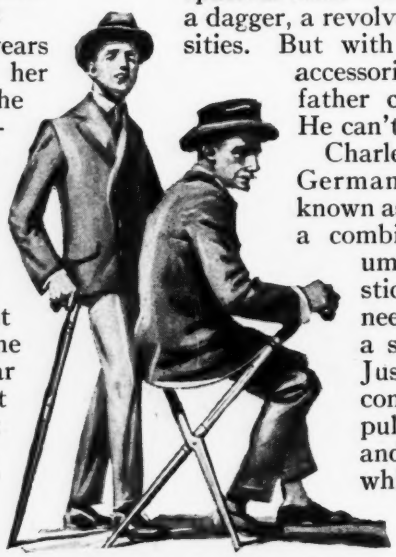
The illustration shows the several parts which go to make up the workbasket. The needle case is carved from a bit of driftwood. The thimble is formed from a piece of tough walrus hide. The comb is carved from a walrus tusk. The skewer-like stiletto is made of bone and is used for making holes in skins, as well as to close the wounds in seals and other animals, to prevent the blood from escaping. The needle is made from ivory; the thread is of reindeer sinew. The toggle is a bit of polished whalebone ornamented with bone rings.

These are strung together on a strip of walrus hide profusely decorated with ivory beads. The comb is probably used more often for getting the tangles out of animals' fur than for the arrangement of the women's hair; for the custom of the Eskimo housewife is to smooth out her hair only occasionally, and then grease it so heavily with whale oil that it stays smooth indefinitely. When she is busy at other things, Madame Eskimo tosses her workbasket over her shoulder out of her way.

Are You Tired? Then Sit on Your Walking Stick

CONSIDER all the changes which the ordinary walking-stick has been heir to. Your grandfather's stick was just a plain old piece of hardy hickory. But look at the stick which father carries. It has an electric lamp to illuminate the keyhole for him at night. It carries a cigar or two and a small box of matches in its spacious head—or tiny bottles of medicine, a dagger, a revolver or other fancied necessities. But with all these walking-stick accessories there is one thing father can't do with his stick. He can't turn it into a stool.

Charles Jaquet, a subject of the German Emperor, otherwise known as the Kaiser, has invented a combination stool, cane and umbrella. It is the stick of sticks. With his cane you need not look about you for a seat when you are tired. Just extend the two limbs connected with the cane, pull out the collapsible seat, and sit down. The members which act as chair legs fold compactly against the cane; so does the seat, which is composed of leather or some strongly woven fabric.



This is the stick of sticks. It is a combination umbrella, cane, and seat, whichever you need

Curing an Auditorium of Echoes

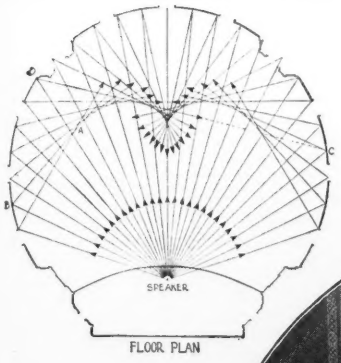


Diagram showing the floor plan of the auditorium of the University of Illinois and the concentration of sounds under the balcony walls

Hairfelt padding mounted on thin furring strips over the dome and walls solved the problem for the University of Illinois

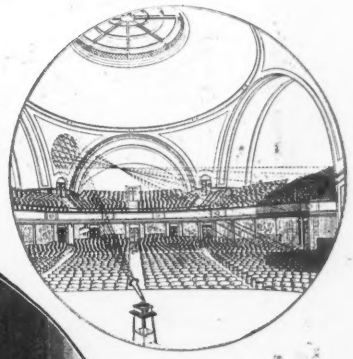
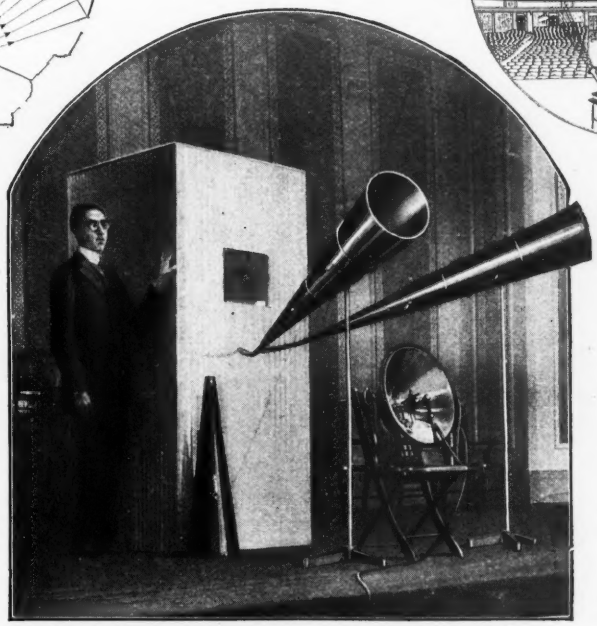


Diagram showing how sounds directed toward an unpadded pendentive in the rear wall were reflected to different parts of the hall



One method employed for locating echoes. Sound was generated for the purpose inside the little house and its direction controlled by two megaphones

THE auditorium of the University of Illinois was a veritable sounding board before its acoustic faults were remedied. Echoes and reverberations were so pronounced as to distress an audience. Various methods of cure were considered—the effect of padding and paneling the walls, the possible advantages of installing wires and sounding boards, and finally, the action of the ventilating system. These were all discarded in favor of padding the walls with sound-absorbing hairfelt.

Before the effective cure was found several methods of tracing sound were tried. One test was made by talking through a megaphone toward different walls. The sound was generated inside a small house and its direction controlled by two megaphones, one being pointed toward a listener and the other toward a wall which gave echoes. No distinct echo could be obtained by speaking simultaneously into the two megaphones. The ticks of a metronome (a clock-moved pendulum for marking exact time in music) produced very little additional effect, but when a sharp intense metallic sound was tried, echoes were obtained from unpadded walls but only faint responses from padded walls. The intense hissing sound of an arc light backed by a reflector gave more pronounced results. It showed that the padded walls produced a marked effect in reducing the intensity of the sound.

Before it was decided to use hairfelt as an absorbing material, curtains and draperies were hung at critical points suggested by the reverberating sounds. Four large pieces of canvas were suspended in the dome. From an acoustic standpoint the auditorium was in a much improved condition as soon as the curtains and draperies were suspended. Of course the architectural features of the auditorium forbad the continued use of curtains. Hairfelt was finally adopted.

Accordingly, one large curved wall was covered with strips of one-inch hairfelt thirty inches wide, placed vertically and thirty inches apart so as to leave bare spaces between them. Following this the dome above the arches and the double curved side walls and single curved rear wall above the balcony were padded. The felt was mounted on thin furring strips which were bent to fit the curvature of the surfaces.

The lamp is connected with batteries secured to the harness saddle or to a riding saddle

An Electric Headlight for the Up-to-Date Horse

OLD Dobbin is becoming up-to-date, or seems to be making an effort to do so in order to keep up with the automobile. He is now wearing an electric headlight, which lets an on-coming vehicle know that he is lumbering along. For this he is indebted to William M. Cloninger, of Paris, Arkansas, who has invented the headlight shown in the illustration. The lamp is connected with batteries secured to the saddle of the harness or to a riding saddle for horseback riding. It throws the light on the roadway ahead and thus helps to avoid accidents.

Horses are apt to be very much like people as to skittishness or steadiness of nerve in the dark, and it will be found much safer to drive a nervous horse over a well-lighted pathway than it would be to coax him along a dark road at night.

The lamp is provided with a reflector which has a double convex lens and is a part of a hollow post through which the conducting wire is lead. This post is riveted at its lower end to a curved metallic base which is secured to the upper part of the bridle. The lamp may be detached when desired and used as a hand lamp around the stable, the hollow post portion serving as a handle.

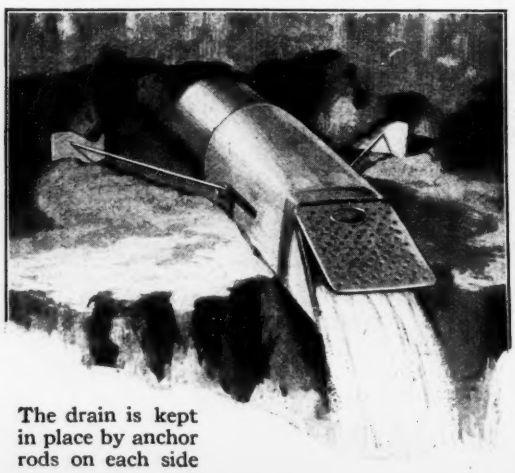
A Soap That Blues the Clothes While Lathering Them

AN Englishman has patented a new laundry soap which he claims will blue the clothes while lathering them for washing. It contains tallow, caustic soda, sodium thio-sulphate and a suitable dye pigment.

The question arises as to whether or not articles requiring more soaping than others will receive more than the desired amount of bluing, and whether the subsequent rinsings will remove the coloring obtained in the rubbing process.

Keeping Hungry Rats and Rabbits Out of Sewers

IT has recently been discovered that such animals as rabbits and field rats are the cause of much trouble in sewers of the smaller towns. They search sewers for food. Prompted by this discovery a manufacturer is now placing on the market a protector which will not only keep out any inquiring animal, but which will also allow sewerage water to discharge just as freely as ever. His device consists of a heavy perforated steel cover, the weight of which is sufficient to keep it closed against an animal when the sewerage discharge is small enough to pass through the perforations in the cover. But if at any time the discharge becomes heavy, the cover will be forced upward on its hinges by the water and a greater discharge area will be obtained. In this case the force of the water itself will keep out the rats.



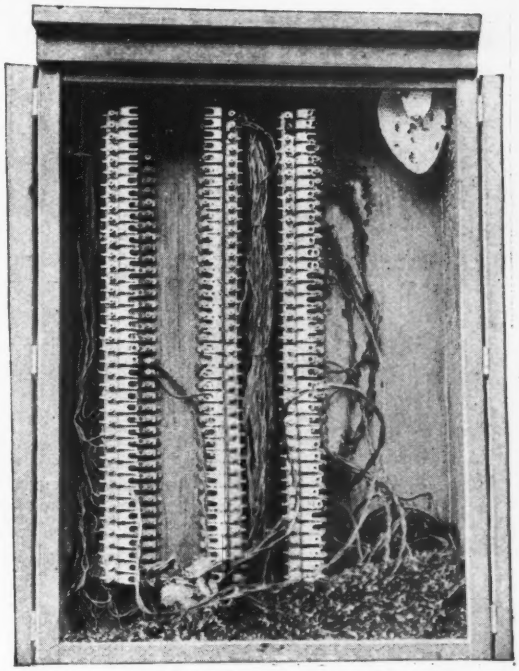
The drain is kept in place by anchor rods on each side

Are You Interested in Cellar Farming? Let the Parasol Ant Instruct You

THE accompanying photograph shows the leaf-cutting or parasol ants of tropical America traveling on the branch of a tree to their subterranean home, each ant carrying a leaf in its powerful jaws. These ants are the most conspicuous, abundant and destructive insects of the tribe of fungus-growing ants which inhabit the territory thirty degrees north and south of the equator. On the other hand they are noted agricultural specialists, feeding upon mushroom-like fungus which they grow themselves in their cellars.

There still remains doubt among scientists as to what the ants do with the leaves they gather. Some surmise that they use them as food; others that they roof their underground nests with them. But the real use they make of leaves, according to a recent book by Belt, entitled "The Naturalist in Nicaragua," is to make a compost in which a minute species of fungus resembling the mushroom will thrive. On this they feed. In other words, Belt calls the parasol ants mushroom-growers and feeders. They do not confine themselves to leaves, he says, but carry off any vegetable substance they find suitable for the compost.

They are very particular about the ventilation of their underground chambers, and they have numerous holes leading from them up to the surface. These they open out or close up, apparently to maintain a regulation of temperature below. If they had had special instructions in underground farming their methods could not be more scientific. They were probably nicknamed parasol ants because of the manner in which they carry the leaves which they gather.

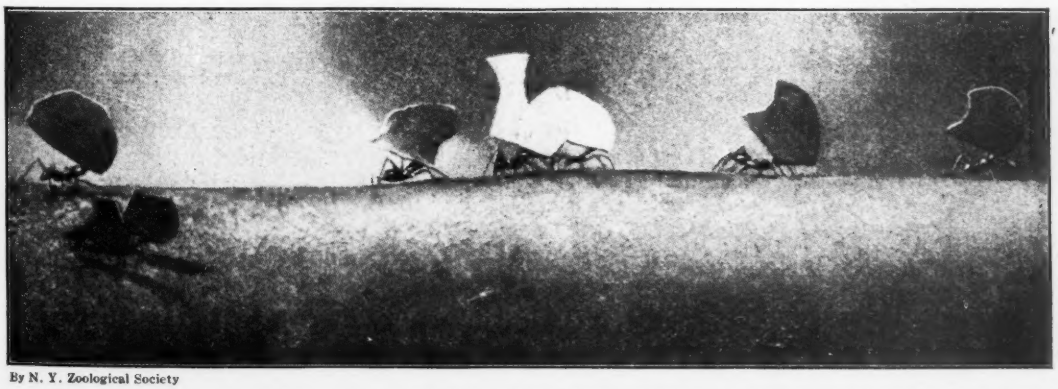


A swarm of bees found out too late that a telephone terminal box is no place for a hive

Even Bees Should Be Careful Where They Locate

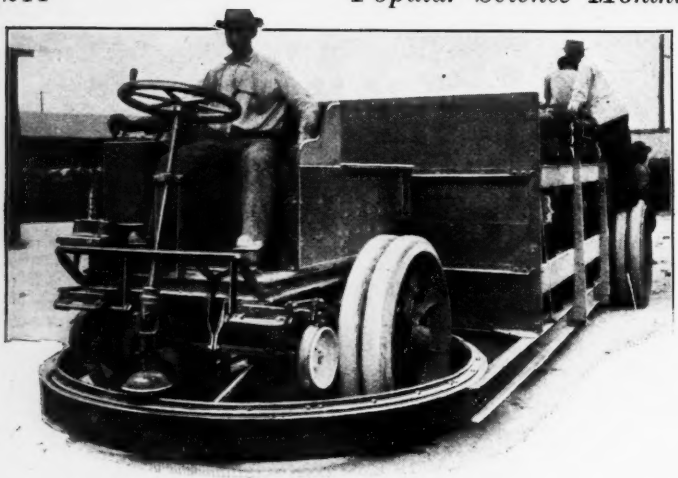
IN the illustration above, the object in the upper right-hand corner is a honeycomb. The black spots on it and on the floor below and on the coiled wires are the bees which lost their lives through poor judgment in the choice of a hive.

They chose a terminal box of a telephone company, and as the manager was not in the honey business his principal concern was to get rid of the bees without insulting them. The fumes of bi-sulphate of carbon did the trick.



By N. Y. Zoological Society

The parasol ants carry leaves and other vegetable substances, sometimes several times their size, nicely balanced on their heads so that the entire body is shaded. This suggested the name



The entire front axle, wheels, driver's seat, battery box, and steering wheel are turned when this cotton truck rounds a corner

Low-Bed Cotton Truck Steered by Huge Bull Wheel

THE motor truck for handling bales of cotton, shown in the accompanying illustration, is not steered by the turning of the front wheels on their spindles. Instead the entire front axle, wheels, driver's seat, battery box and steering-wheel mechanism is revolved in relation to the center line of the truck.

This is accomplished by placing the entire front assembly, wheels and all, within a huge internal-geared bull wheel attached to the side frames of the truck. The front wheels simply revolve on their axle but do not turn in relation to it, the steering of the truck being done by turning the front assembly within the bull wheel by means of a gear in mesh with the teeth of the former.

Thanks to this construction a truck can be utilized with a frame only two inches from the ground, yet it can be steered easily and turned in a remarkably short radius. A low frame is necessary to facilitate the lifting of heavy bales. A truck of this kind can carry an exceptionally heavy load.

This double-caliper can quickly make measurements where another would be worthless

Rubber Instead of Glass Eyes for Wounded Soldiers

ARTIFICIAL eyes of rubber are taking the place of the old-style glass optic for wounded soldiers in Europe. The rubber eyes have the advantage of being unbreakable, and as they are of pneumatic construction they maintain an elastic contact between the eyelids and the back of the orbitary cavity.

To make the new rubber product, a cast formed of liquid plaster is made of the orbitary cavity and from this is constructed an eyeball, the face being of vulcanite. The front and back parts are made of soft rubber, there being a space between the two parts which is occupied by air, making the eyes pneumatic.

A Caliper That Makes Extraordinary Measurements

A THREE-PIECE caliper which looks like an ordinary caliper bent back upon itself is the invention of a Chicagoan, Mr. Franklin J. Wolff. It consists of two S-shaped pieces of steel pivoted together at their centers, and a small machinist's rule pivoted to the end of one of these pieces. The cleverness of the caliper is to be found in the manner in which it can measure both inside and outside diameters which are so obstructed that an ordinary caliper would be worthless for the purpose. For instance, an ordinary caliper could never measure the internal diameter of the steam-valve body shown in the illustration; but the new duplex caliper does this very readily. When the caliper is fully opened, it is only necessary to read the mark upon the rule opposite which the pointed end of one of the S-pieces stops, and the measurement is obtained.

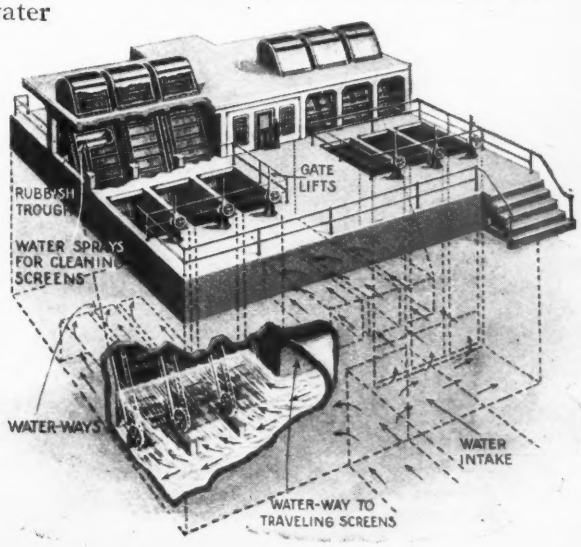
Washing River Water for Power Plants

Sifters on endless chains keep out the rubbish

A POWER plant cannot use the water from the city mains since that would be too expensive. Instead it cleans the water of a river and pumps that up into the boilers and into the steam-condensers as it is needed. To-day, huge moving screens are used in the larger plants throughout the United States, but only a year or so ago, they were using stationary screens placed in the supply-pipes which lead from the water. These were very unsatisfactory; for after heavy rain storms, the water would be filled with rubbish.

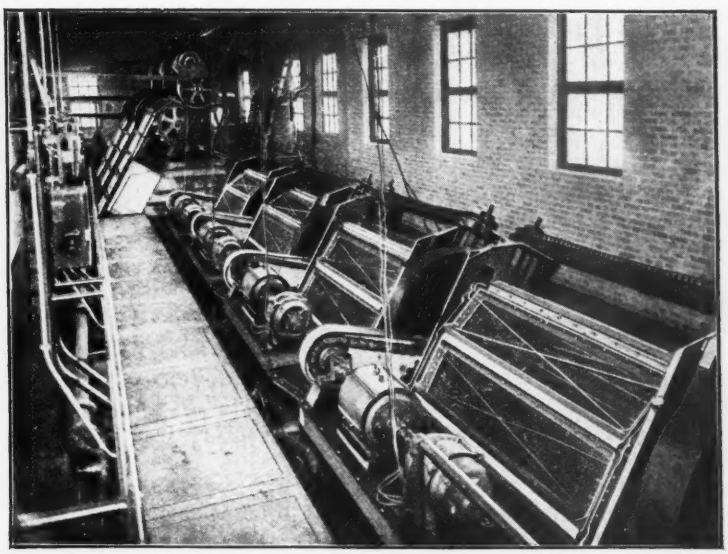
In the new form of filter this trouble is done away with. Here the screens are very much like platforms on a traveling-staircase. The water to be cleaned must first pass through the moving screen-sections before reaching the supply-pipes. When the rubbish which is carried along reaches the top of the filter, it turns around with it on a large sprocket-wheel and then meets a powerful spray coming from behind. It is thus whipped off the filter into a trough of running water, and from thence it is washed into the down-stream side of the river, out of the way.

These filters are built in single units which occupy a space six feet wide and about forty feet long. Where the water is let in from the river in channels more than six feet wide, a number of units, forming a battery of filters, must be placed side-by-side. In each unit, the screen-sections are placed close together on two endless steel chains driven by a small electric motor.



At right: Diagram showing the details of the device and the course of the water over the screens

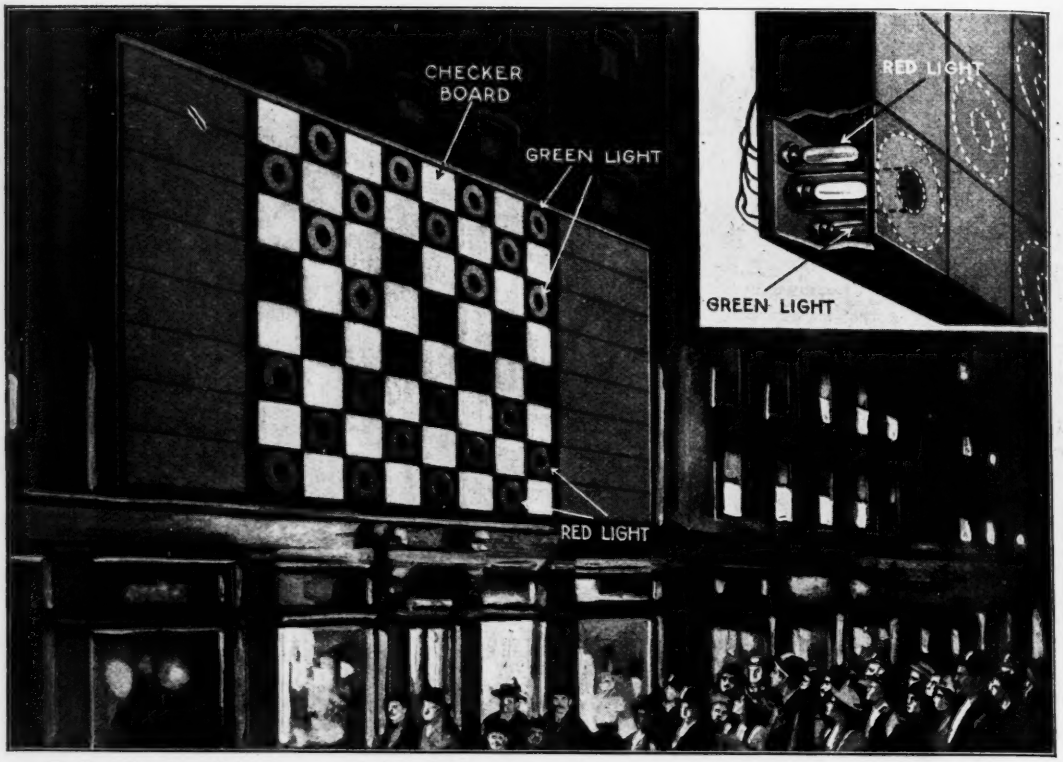
The screen consists of two strands of chain carrying wire-covered frames



Each unit is run by a small five-horsepower motor and is capable of cleaning sixty-nine million gallons of water per day

Playing Checkers with Electric Lights

Do you want to draw a crowd in front of your place? This bulletin-board game will do it



Red and green lights are used for checkermen and a white light for a king. There are one thousand nine hundred and twenty lamps displayed upon the board and one thousand and twenty-four in the checker squares. About sixty thousand variations may be shown

ANTHONY NELSON of St. Paul, Minnesota, is the inventor of a board which plays checkers and other games automatically. When the board is used for playing checkers it is capable of showing sixty thousand or more variations. The games or records are worked out on sheet brass and then placed on a cylinder which revolves slowly, requiring twenty-five minutes to make one revolution. The time required for each game is about eight minutes.

The operation of the board may be described as follows: On the surface of the brass sheets is a series of grooves to conform with the particular checker game being played on the board. Riding on the surface of these records, which are not unlike the records of the old-time music boxes, are ninety-six arms of a non-conducting material. On the underside of the arms is placed a runner or needle on a slant. These runners or needles drag on the surface of the cylinder as it revolves.

Each arm is pivoted at one end. On the upper edge the conducting bar is secured with the contact point at the free end. As the cylinder revolves the runners engage with grooves on the record, raising or lowering the arms. When the arms are raised the circuit is broken and the checker squares controlled by those arms are darkened. At the contact point is a groove extending longitudinally across the terminal board. Mercury is used to insure a perfect electrical circuit, as any failure of the lamps to light on the board would spoil the effect of the game. It requires three arms to control each square on the checker board.

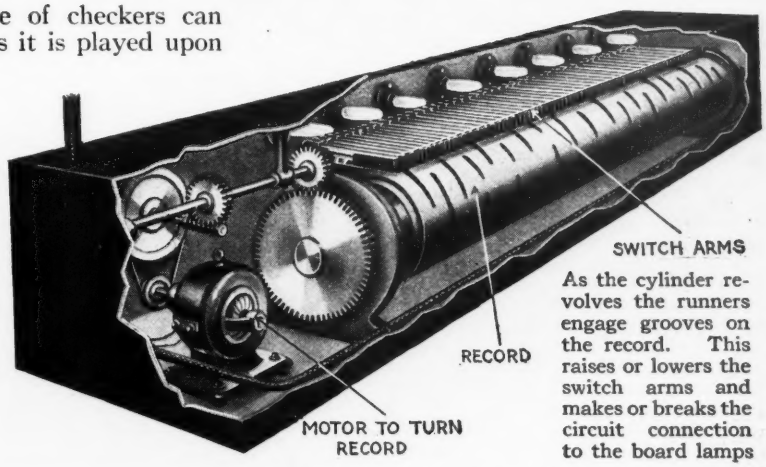
The color scheme is red and green lights for the checkermen, and a white light for the king. When the king is in play a letter "K" with a light background is displayed at the end of the cylinder. Anyone with

the slightest knowledge of checkers can understand the game as it is played upon the board. There are one thousand nine hundred and twenty lamps displayed upon the board and one thousand and twenty-four lamps in the checker squares.

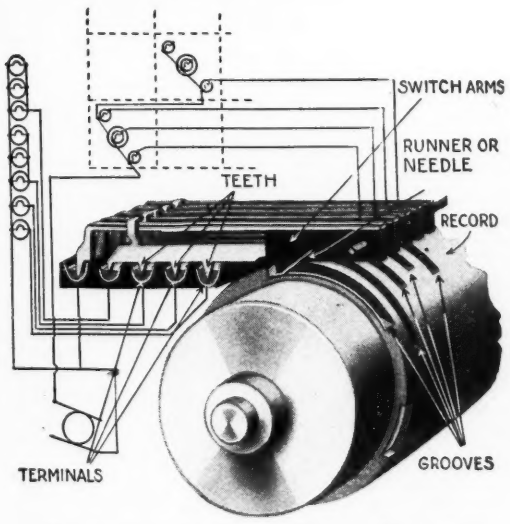
The board is placed in a perpendicular position. It can be seen at a considerable distance when illuminated at night. The squares upon which the checkers move have a circular opening or ring, behind which the lamps project. When in play each lamp has the appearance of a disk to conform to the size of a checker in relation to the checker square.

In all checker games the opening move goes to the black. The first move is considered an advantage, and checkers are reversed after each game. On the automatic board this rule is followed out. The green checker represents the black and moves first, playing from the bottom of the board the first game and from the top of the board the second game, reversing each game.

The board may be used for other games, or for advertising purposes.



As the cylinder revolves the runners engage grooves on the record. This raises or lowers the switch arms and makes or breaks the circuit connection to the board lamps



The games or records are first worked out on sheet brass and then placed on a cylinder which revolves slowly. On the under side of the switch arms needles, placed on a slant, drag on the surface of the revolving cylinder

Conveying Music by Wireless—A Modern Miracle

THERE is more fact than fancy in that old song, "There is music in the air." You can lie in your comfortable berth on a liner speeding out to sea and hear the clear, limpid notes of Caruso as he sings to an opera audience on land, many miles away. In the seclusion of your own home you can hear the world's greatest artists and catch the spirit of the audiences to which they are singing, even to the minutest details of applause, although the opera house may be in a distant city. These are modern wonders wrought by wireless.

Not long ago the passengers on a steamer far out on Long Island Sound had the interesting experience of hearing musical selections come in through their receivers. Only recently a group of wireless engineers and musicians held sensitive receivers to their ears and heard music which was conveyed to them by wireless from a distant part of the city.

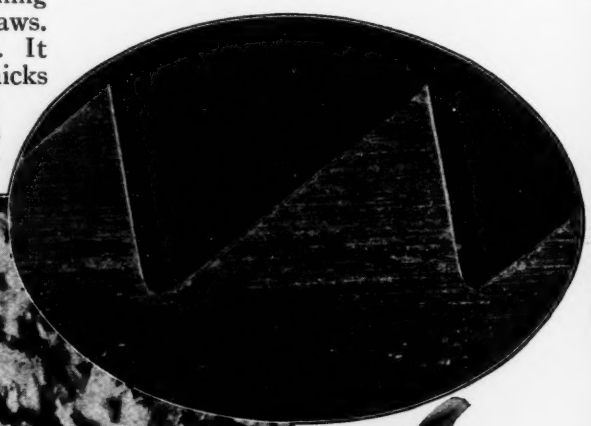
Briefly, this demonstration was made as follows: From the sound-box of a talking machine the music was led into the transmitter of a wireless sending station. Here it was transformed into an electric current which changed its direction several hundred thousand times a second. Then it was transformed into electromagnetic waves which traveled in all directions away from the aerial wires at the rate of 186,000 miles a second—the speed of light. The waves which reached the aerial wires of the receiving station were then absorbed and converted back again into an electric current. The music was then led into the telephone receivers worn by the audience.

Discovering the Well Known Saw

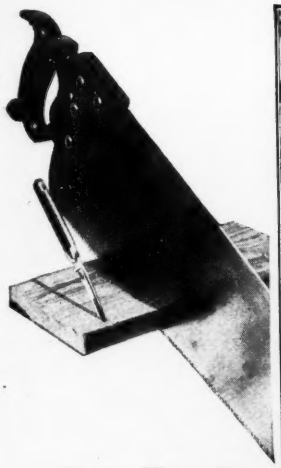
Do you know that a rip-saw is really a series of chisels? Look at its teeth under a microscope and see for yourself

IN this day and age of enlightenment it is impossible to believe that there is anybody who doesn't know everything about saws—plain, ordinary carpenter saws. A saw is the simplest thing in the world. It is made of flexible steel with little nicks along the edge that tear a narrow slot in a piece of wood. Of course! But do you know the real difference between a rip-saw and a cross-cut saw? If you do you know more about saws than do most mechanics.

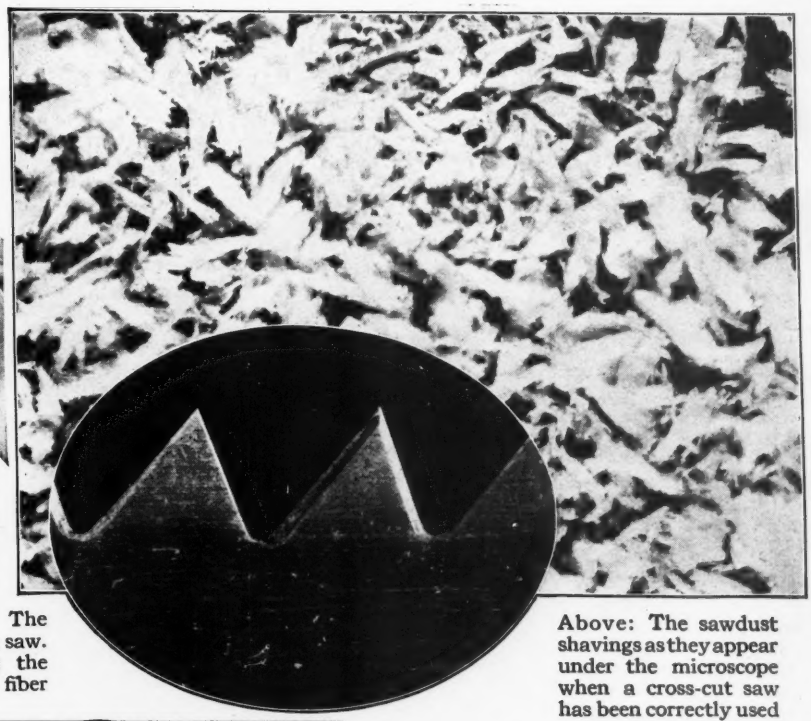
The fact is that a rip-saw is nothing more or less than a close-knit succession of tilted chisels. If a chisel is driven lightly into a board and pushed lengthwise with the grain it picks up a shaving. This is the principle on which the rip-saw cuts. To avoid side friction and binding, the teeth of a rip-saw are swaged or projected outwards from the saw-blade so that nothing but the extreme points experience any side friction. These extreme points are brought to needle-point sharpness. In other words, the tooth of each rip-saw cuts with its point and about one half of the edge.



In the oval above, the teeth of the rip-saw are shown magnified. They are sharpened on the end so that they chip off the ends of the fibers that run lengthwise of the channel, just as a chisel does, as is shown in the lower right corner of the picture. At left of the picture are the shavings as they appear when greatly magnified under the microscope, if the rip-saw has been correctly used



Above: The action of a cross-cut saw is like that of a knife-blade. It cuts across the grain



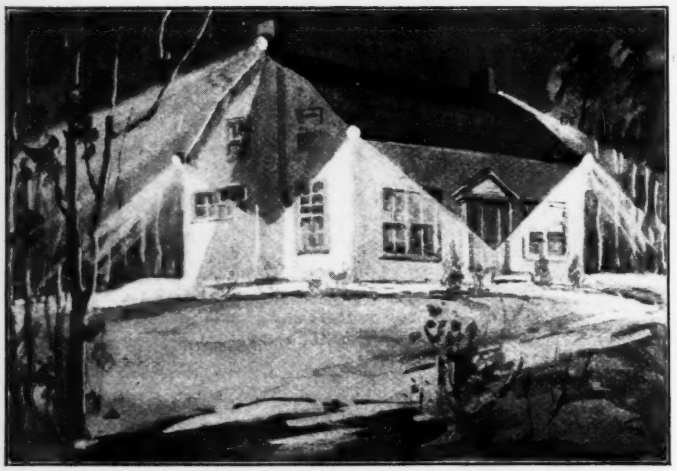
At right in oval: The teeth of the cross-cut saw. Alternate teeth cut the ends of the wood fiber

Above: The sawdust shavings as they appear under the microscope when a cross-cut saw has been correctly used

When a rip-saw has been used where a cross-cut saw should have been employed the shavings, or rather tearings, will look like this under the microscope

The action is quite different with the cross-cut saw. If a chisel is pushed across the grain of a board it sticks and tears up the wood fibers. If a knife is used no great resistance is encountered. After drawing the knife across the grain along two lines the short cylinders of wood-fiber between the two can be easily broken loose, leaving a channel such as that cut by a saw. Now, if you substitute the tip of the cross-cut saw-tooth for the point of a knife and the leading edge of the tooth for the edge of the knife, you will see at once the action of the cross-cut saw. Alternate teeth cut the ends of the wood-fiber, and the following teeth eject the fibers as sawdust. The ripping process parts the wood-fiber and removes shavings, all of which is done so long as the outside leading edge of the tooth is sharp.

The skillful workman learns to regard his saws as well as his other tools as having spheres of usefulness peculiarly their own. To use a rip-saw where a cross-cut saw is needed may result disastrously in a fine piece of work. A comparison of the pictures of shavings and "tearings" will show the wastefulness of substitution.



Push-buttons installed in the upper and lower halls and in the bedrooms control the lamps, and the grounds can be flooded with light when burglars or tramps are prowling

Making a Bungalow Unpopular with Night Prowlers

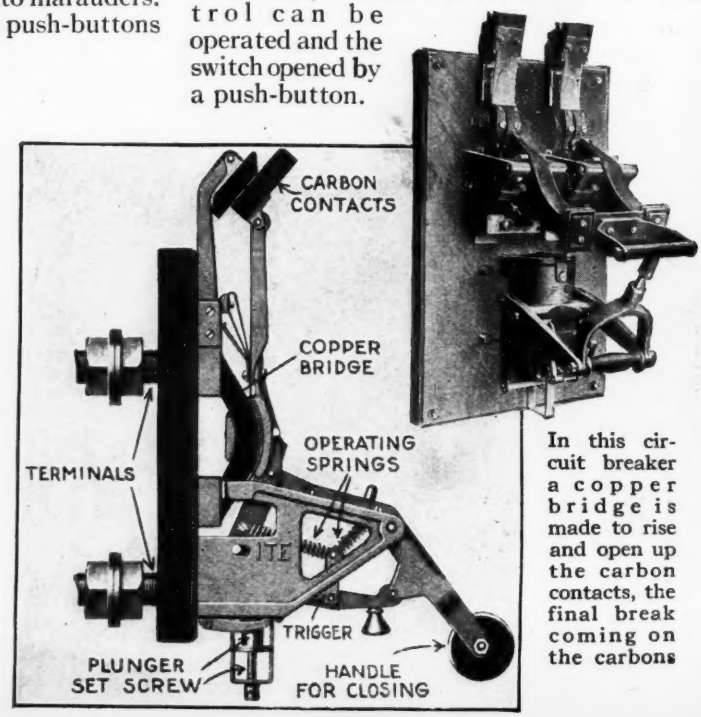
THE evil-doer loves darkness rather than light, so the Good Book says, and a Toledo man has found in the saying a suggestion for keeping tramps, burglars and chicken thieves away from his residence. The house is square and stands on a knoll, so when he installed a powerful nitrogen tungsten light in a reflector at each corner, the whole place presented a brilliant spectacle, not at all attractive to marauders. The lights are controlled by push-buttons inside the house.

What a Circuit-Breaker Really Is

AN ordinary overload circuit-breaker is merely an automatic electric switch which is operated by an electromagnet for opening the circuit whenever the current becomes dangerously high. Circuit-breakers are installed wherever large currents are employed, and if it were not for them many powerhouses would be burned up because of the tremendous currents that would develop from accidental short circuiting.

The accompanying illustration shows a type of circuit-breaker that is now being used extensively in manufacturing plants. It can be adjusted to open a circuit at a certain maximum current. When such a point is reached, the current flowing through a copper coil will pull up the plunger. This strikes against the trigger and allows the operating springs to pull out the arm carrying the copper and carbon contacts. The carbons remain closed until the copper bridge is lifted from its contacts. The final break in the circuit therefore is made by the carbons, and hence the formation of an arc on the copper is prevented. This not only prevents the copper bridge from becoming fused, but it also prevents the copper from burning up.

There are numerous other types of circuit-breakers serving many different purposes. There are under-load breakers for circuits that charge storage batteries, which open the circuit should the charging voltage drop and allow the batteries to discharge into the charging source; and there are others very much more elaborate in the powerhouses themselves. Such are the distant-control breakers, for instance. Should any serious trouble occur the control can be operated and the switch opened by a push-button.



In this circuit breaker a copper bridge is made to rise and open up the carbon contacts, the final break coming on the carbons

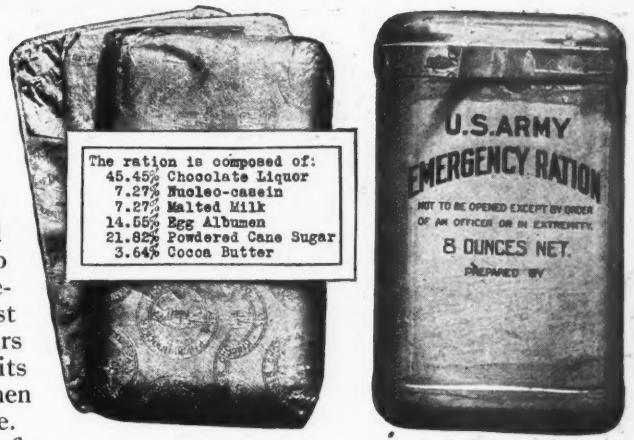
The Most Nutriment in the Least Space

IT often happens that a forest patrol discovers a small brush fire, which, if not checked in its incipient stage, may soon grow into a great conflagration that may lay waste to a whole country-side. In many instances the forest guard dares not attempt to send for help but starts in to fight the fire single-handed. These lone battles against such great odds often last for hours until the fire is checked or until its smoke has summoned other patrolmen to the assistance of their comrade.

Should the guard discovering the fire be forced to give up the single-handed battle after several hours work in order to seek food, a fire which might otherwise have been checked while still in its infancy may sweep a great forest before it, resulting, not only in the loss of thousands of dollars worth of valuable timber, but of other property and, in many instances, of lives.

For this reason the Forest Service demands that every one of its forest guards must carry an emergency ration with him. The ration consists of three cakes resembling chocolate, each cake being one meal.

The cakes are wrapped separately in tin-foil and are inclosed in an airtight tin case which may be carried conveniently in a saddle bag or coat pocket. The net weight of the ration is eight ounces. It is the same as that included in the equipment of the United States Army. It is composed of 45.45% chocolate liquor; 7.27% nucleo-casein; 7.27% malted milk; 14.55% egg albumen; 21.82% powdered cane sugar; and 3.64% cocoa butter.



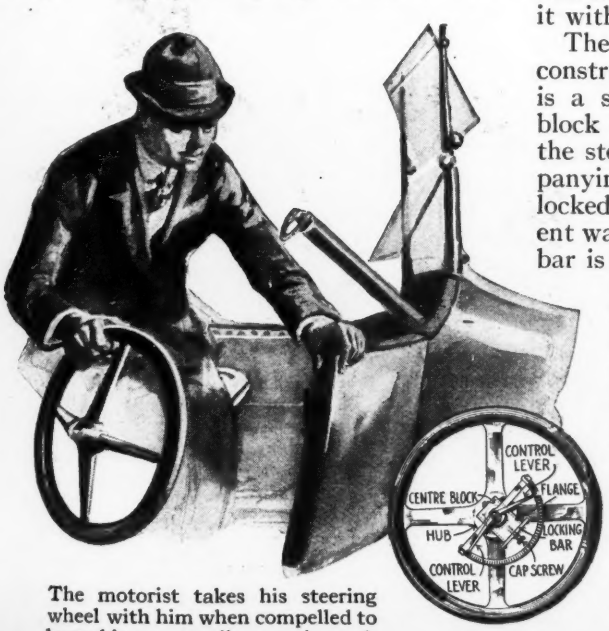
Every ranger in national forests must carry an emergency ration as part of his equipment

Removable Steering-Wheel to Foil the Automobile Thief

A SHIP without a rudder is helpless, and so is an automobile without a steering-wheel. That seems to be the thought behind a new invention designed to prevent the stealing of automobiles left at the curb. The new wheel is easily attachable and detachable, so that the owner can take it with him when he leaves his car.

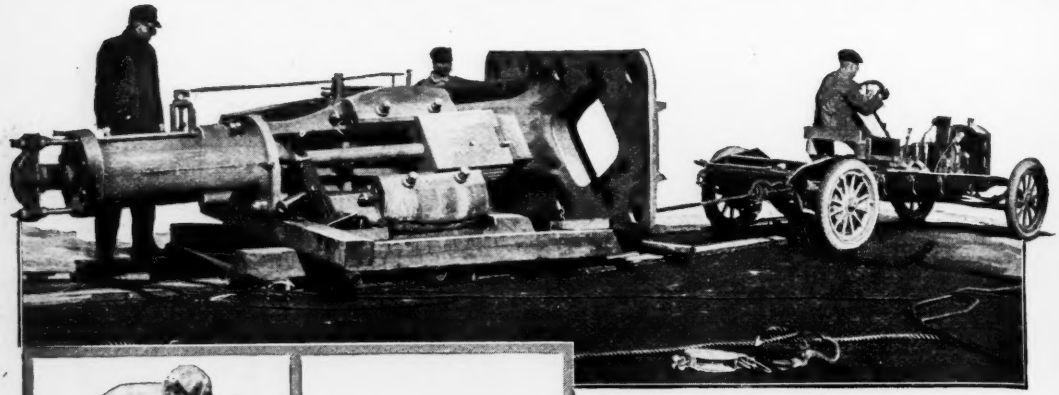
The wheel differs from the conventional construction in that it has a hub in which is a slot which fits over a similar-sized block rigidly secured to the upper end of the steering post, as shown in the accompanying illustration. The hub may be locked in place on the block in two different ways, according to whether the locking bar is integral with the wheel or with the block. In the first method, a small bar is pivoted at one side of the open end of the wheel hub and locked in position over a small pin at the opposite side. In the second method, a small bar is pivoted to the block at the center. As the bar is revolved about its pivot, notches provided at the ends of the bar on opposite sides fit over pins on the hub.

To prevent a thief from fitting a wheel of his own of the same type, the hub is provided with a socket into which a pin in the block fits.

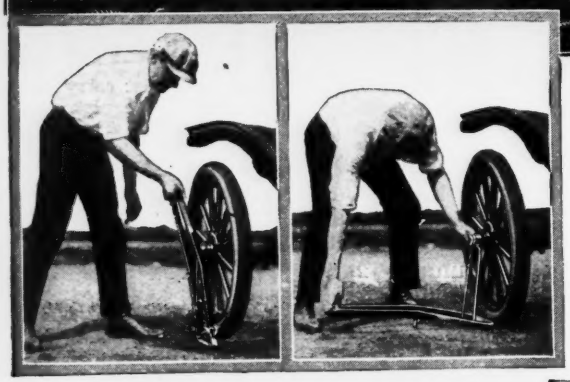


The motorist takes his steering wheel with him when compelled to leave his car standing at the curb

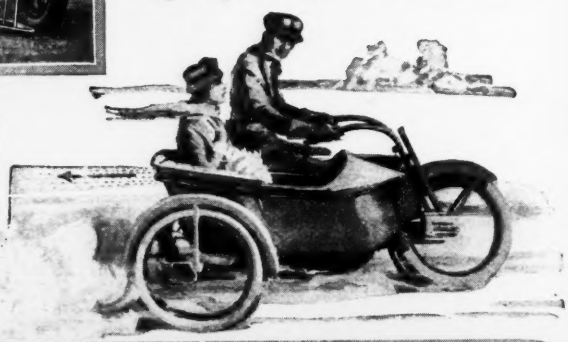
New and Bigger Jobs for the Sturdy Truck



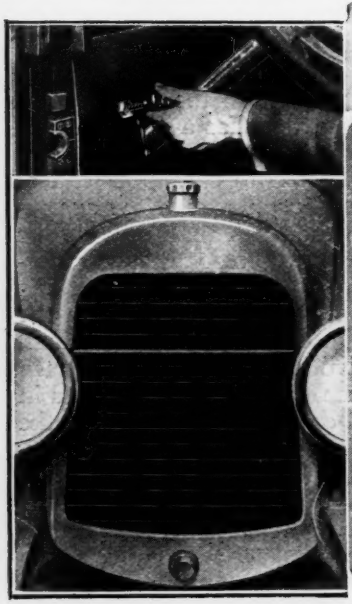
A fifteen-ton steam-hammer moved a quarter mile on rollers by an automobile chassis. So heavy was the piece of machinery that steel rollers placed under it were crushed like egg shells



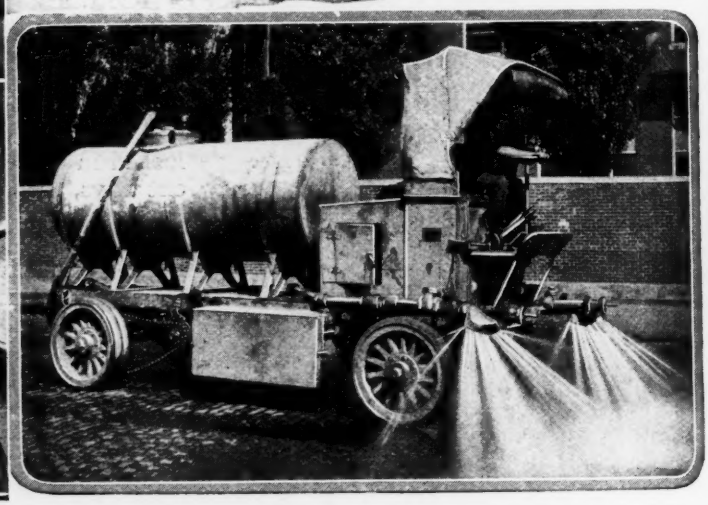
At left: A new jack to lift the wheels off the floor when the car is in the garage. The lip of the jack is placed under the hub and the lift is accomplished by a single upward motion of the hand



At right: Preventing back draughts of dust with an air scoop. The wind pressure enters the scoop, placed at the front of the side-car, and is forced out at the rear, breaking up the air eddies that carry the dust

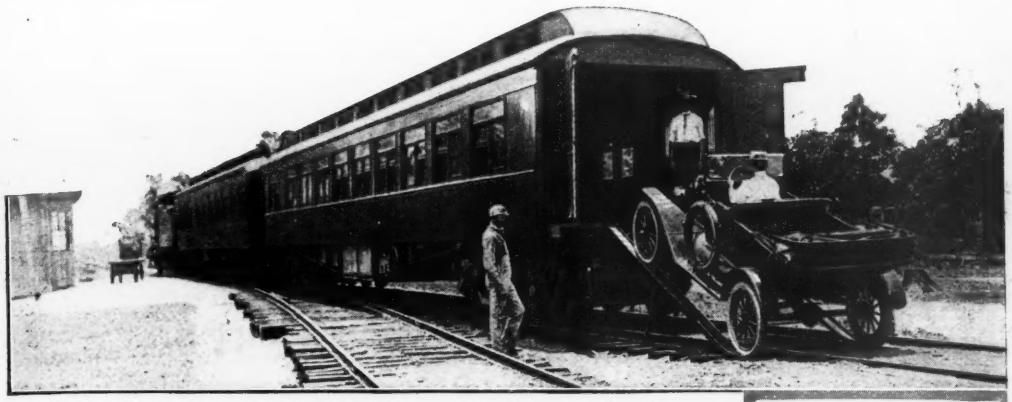


A radiator shutter, operated from the driver's seat, keeps the water from freezing

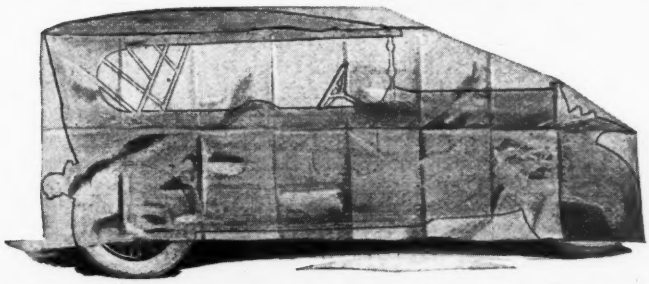


An electric street-sprinkler with sprinklers in front, giving the driver better control. The three-ton truck carries an eight hundred-gallon water tank

and the Latest Refinements for the Pleasure Car

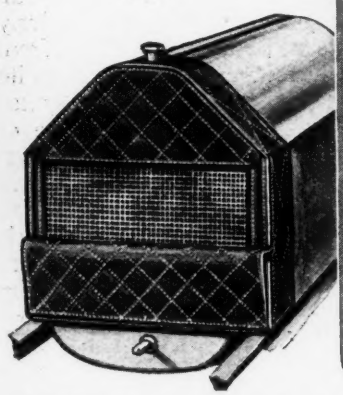


The Louisiana State Board of Health has turned one end of its laboratory on wheels into a garage for a small automobile. The automobile is run into and out of its car on steel chutes

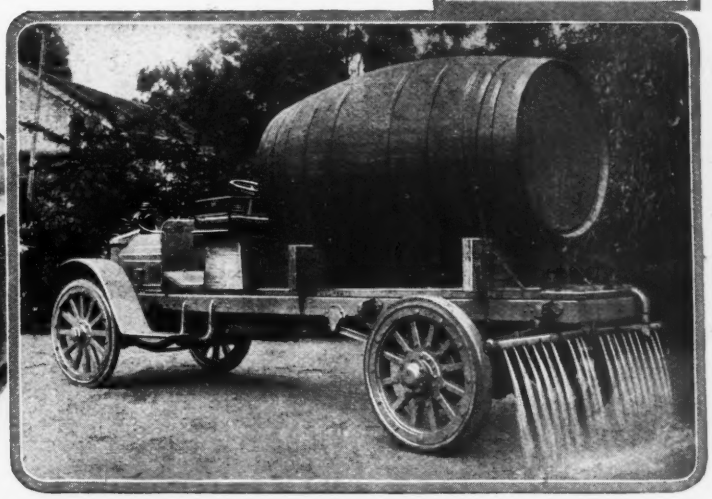


Automobile covers of paper are used when the car is idle to keep out dust and dirt and prevent rusting and tarnishing of metal parts. The covers are made for small, medium and large cars, and the paper may be as heavy or light as desired

At right: An eye-protector against wind pressure. It does not cover the eyes. The goggles closely fit the side of the face and extend outward and downward, thus forming an effectual windbreak without shutting out the air or affecting vision



A folding blanket curtain for the radiator, keeping the heat within and preventing freezing



Street cleaning in Bombay with a modern truck and a huge barrel reservoir. This apparatus, minus the truck, is centuries old. It somewhat resembles our own sprinkling carts

How Are Photographs Made in Natural Colors?

Nearer and nearer is the camera coming to perfect representation of the blush of the rose

By A. Press

ALL photography depends on the fading of colors when exposed to a strong light. Of course, when a colored body fades, it would not be reasonable to suppose that it still had the precise chemical composition or structure that it had before fading. It is possible in many cases to magnify or accelerate the fading effects by steeping the partly faded object in a suitable solution. In photography this process is called developing. After the development it is only necessary to dip the faded silver bromide plate or paper into a solution of "hypo" which dissolves the unfaded silver bromide and leaves the black or faded variety of silver to give the finished negative.

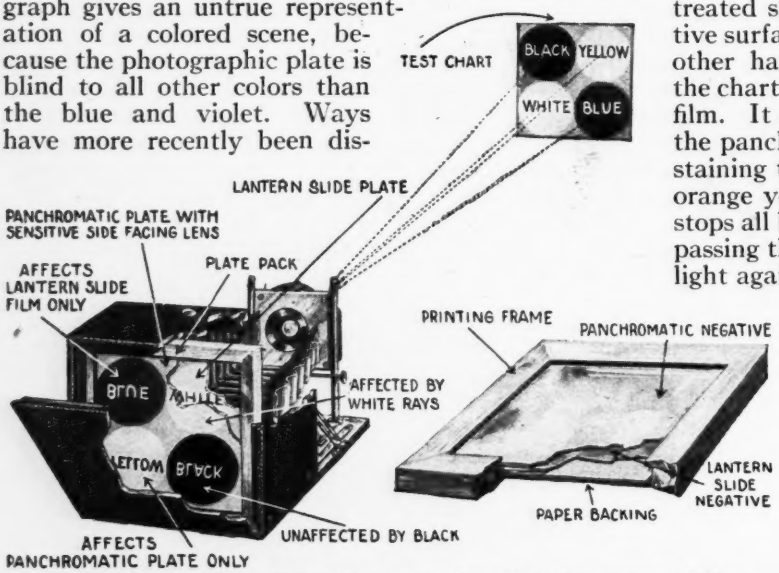
Such a negative, however, is not a colored photograph, because silver bromide always fades to black. If a mixture of chemicals could be found in which the components of the mixture faded individually to different colors, then color photography would be a fact and not an experiment involving subterfuges.

One difficulty has been that silver bromide and its allied salts are found to fade with practically only blue and violet rays of light. Hence, an ordinary photograph gives an untrue representation of a colored scene, because the photographic plate is blind to all other colors than the blue and violet. Ways have more recently been discovered of making silver bromide plates sensitive to all colors, but the chief difficulty now is that the silver salts so treated always fade to the same black color. Thus the great problem in color photography to-day is how to give a different color or tone to the different sets of silver grains faded by the differently colored rays occurring in a composite colored picture.

An exceedingly simple and ingenious method of two-color photography has been devised by Gurtner. Two grades of plates are required. One is a lantern-slide plate, which must be previously stained by means of a napthol orange solution. Such a lantern-slide plate is generally very slow. This plate is then placed face to face with a panchromatic plate in an ordinary camera and exposed through the glass of the lantern-slide plate.

Turning to the illustration, it will be seen that a yellow patch in the chart photographed will send out yellow light rays that do not fade the silver of the lantern-slide layer because only blue or violet rays can affect it. Such yellow rays, however, in passing through into the panchromatic plate can affect the specially treated silver forming the sensitive surface of the plate. On the other hand, the blue patch in the chart affects only the lantern film. It cannot pass through to the panchromatic film, since, by staining the lantern film with an orange yellow dye, it effectively stops all blue or violet light from passing through. With the white light again, because it really has in it a mixture of yellow and blue rays, it affects both plates in the camera, whereas the black patch in the chart affects neither of the corresponding portions of the plate.

Thus all the blue patches of the chart are photographed on one plate and all the



The Gurtner method of obtaining two-color effects by means of blue and yellow patches of color on the plates. It is also possible to obtain patches of white and a fairly good substitute for black by this method

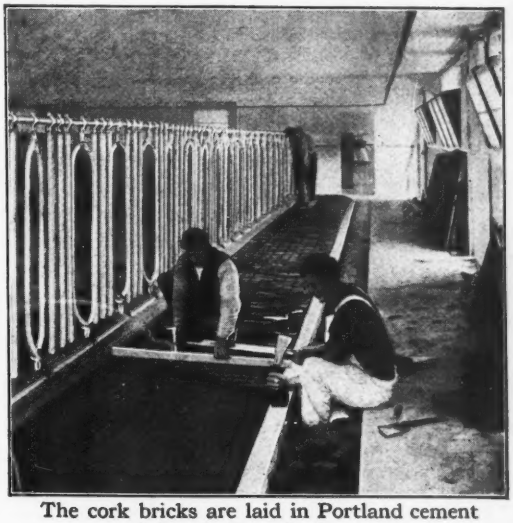
yellow on another. This enables one to tone to different and appropriate colors those patches of the picture corresponding with different colors in the chart. It is then only necessary to combine the blue and yellow pictures face to face, to obtain the required color photographs. Should transparencies be made, to correspond with the separated blue and yellow colored portions of the chart photographed and then overlapped, it will be possible to obtain not only patches of white, where no color appears in either positive, but what will pass for a very good substitute for black where the very strong yellow of one plate overlaps the blue of the other.

The panchromatic negative plate can be used for making a blue print on glass by exposing with a fixed-out plate, sensitized with blue-print sensitizer solution. The yellow picture positive can be obtained by means of the lantern slide negative used with a collodio-chloride printing-out paper. The fixing should be done with ammonia to give a yellowish red positive. This positive should then be attached face to face to the glass blue-print and then a two-color photographic effect will be obtained.

You Can't Find Your Brushes or Your Razor in Your Bag? Then Try This

AN automobile accessory which is intended to do away with certain troubles of the tourist, such as the misplacing of brushes, combs and other toilet articles, has been incorporated in the product of a Philadelphia maker of bags and suitcases. As shown in the accompanying illustration, it consists of a strap slipped through the slots in a band sewed to a leather flap which fits into the cover of the suitcase and is held in place by means of snap buttons. Each toilet article is slipped into one of the strap loops. Then the strap is pulled tight to hold it in place. The loops are adjustable for larger articles by removing the strap from one slot and inserting it in the next. When filled, the flap is folded over into the cover and held in position by snap buttons.

Each article fits in the loop of a strap which is adjustable to different sizes

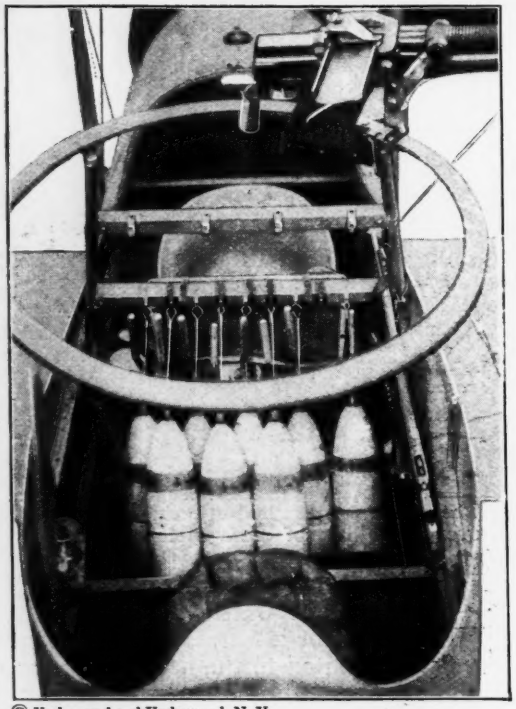


The cork bricks are laid in Portland cement over a sub-base of crushed stone or ashes

Comfortable Cork Brick Flooring for Cattle

THE search for a warm, non-absorbent flooring suited to the needs of horses, cows, hogs and sheep has led to the adoption of cork brick. The brick consists of finely granulated cork and refined asphalt, heated and thoroughly mixed, and then molded under pressure into bricks nine by four by two inches. The flooring is laid in cement mortar over a sub-base of concrete and crushed stones or ashes.

As a flooring for stables, cork brick has been found to be durable in service, warm, easy under foot, and entirely sanitary. It is also practically noiseless, never slippery, readily installed, and moderate in cost. Breeders of prize stock cattle have been on the alert for several years for an improved type of flooring to protect their stock against changing weather. Cork brick flooring is said to give a maximum of comfort. One chief advantage of it is that it allows of frequent washing because it dries so quickly and because it does not become slippery and dangerous under foot. Several large dairy farms in the middle west are said to have installed the new brick in their barns.



© Underwood and Underwood, N. Y.
Eight heavy shells suspended in a French biplane in which is no sighting instrument

graph, showing eight heavy shells suspended in a French biplane, is particularly interesting, because of the utter absence of any sighting instrument. Evidently the bombs are aimed by a trained instinct. The manner in which they are suspended suggests that they are first unhooked, that the contact-fuse is then "sensitized," and that the bombs are dropped over the side of the fuselage, all by hand.

A still more interesting feature of the picture is an aerial "gun turret" for the machine gun. From such a rotatable machine-gun carriage more is demanded than from a battleship's turret. The arc of fire is the whole horizon, and the gun must be ready to fire at angles of over forty-five degrees, up or down. That is why this mount is so very simple. It is really but a circular track around which the gun is shifted, and on any point of this track the gun may again be independently turned through a wide arc, right or left and up or down.

The problem of obtaining unobstructed fire in nearly all directions has been solved in an ingenious way—the marksman simply stands in the center of the circular track.

How French Air Fighters Handle Bombs and Machine Guns

BEFORE the great war, no military officer really knew what was to be expected of bombs dropped from aircraft. There were radicals who not only denied that a dropping bomb could be aimed, but also declared that air bombs would be harmless because their destructiveness would be limited to a small radius. When the war came, the practical French settled the question by dropping their regulation artillery shells from large, weight-carrying aeroplanes. They removed only the copper ring which in ordinary use guides the missile through the rifle barrel, adding instead a guiding windvane in the rear, to make sure that the contact fuse strikes the ground first. The accompanying photo-

Photo Amer. Press
The slightest contact will cause the bomb to explode

Fishing for Enemy Aircraft with an Aerial Death Hook

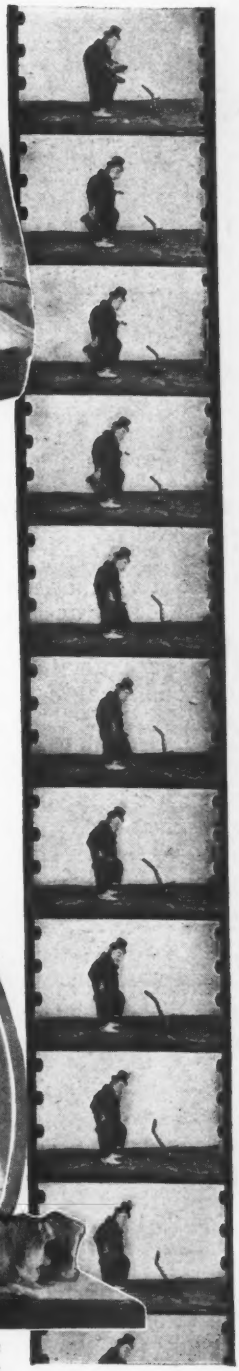
AN aerial bomb has been invented by Joseph A. Steinmetz, of Philadelphia, which simulates the old-time torpedo in that it is suspended from an aeroplane or dirigible by a long cable. There are three projecting arms or hooks on the bomb, any one of which coming in contact with an object causes the bomb to explode. A contact fuse would serve the same purpose, however.

When an airman sets out to "hook" an enemy craft he soars high into the sky, lets out his bomb to any desired length, and then looks below him for victims. If he spies enemy aeroplanes he descends quickly, letting down the bomb until the projecting arms come in contact with the enemy craft.

Statues that Run, Dance and Fight

The latest development in moving pictures is the funny animated clay figure

Photos Press Illus Serv.



THE motion-picture folk have hit upon another novelty. They call it "animated sculpture," which means that they take statues and make them move. The feat isn't as difficult as it seems, although the work required is infinitely greater than drawing hundreds of pictures with pen and ink for making an animated cartoon.

The figures are first fashioned in clay, then changed to different poses, photographed one by one and projected upon the screen without a break so that they jump about on the screen

The three dancing chorus girls and the musicians

Mrs. Murphy tells Mrs. Flynn a thing or two in the animated sculpture play, the "Battle of the Suds." Before the film will have been completed thousands of Mrs. Murphys and Mrs. Flynns will have been fashioned to furnish the action for the most energetic battle royal

Even a clay figure is afraid of an animated snake.

Miss Dayton's studio contains countless thousands of plastic clay figures. At the right of the sculptress is a replica of the old Windsor Hotel depicting the fire

as if they were real. The effect is startingly realistic and highly amusing. In one of the films only recently completed there are no less than nine figures, all of them moving about as if they were flesh and blood. The rather jerky action serves only to enhance the amusing result.

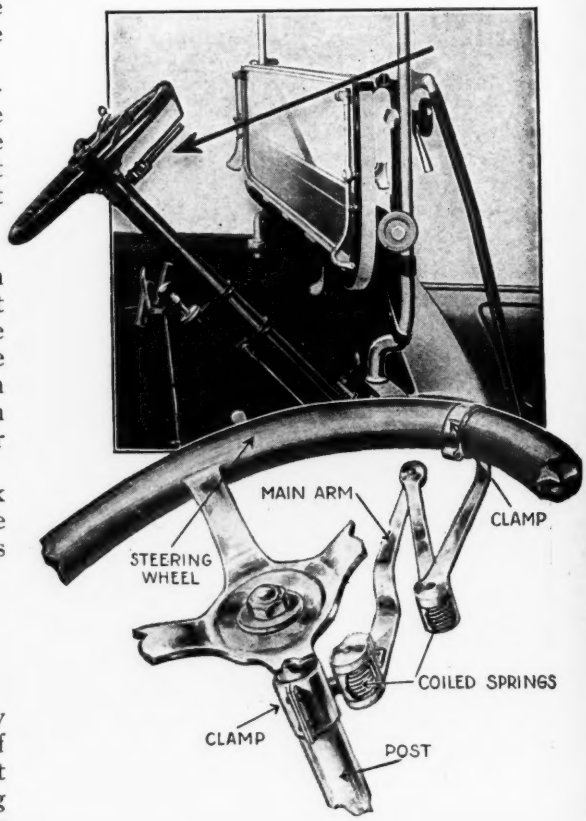
To appreciate the amount of labor required in making these new films it must be remembered that each time one of the sculptured figures moves a new pose must be made. This means, in other words, that the camera must stop until the sculptor goes over each plastic figure and molds it into the correct position before he can photograph it. There are sixteen different poses to a foot of film. Hence for the ordinary reel of one thousand feet there are sixteen thousand separate poses for each figure. Imagine the work required when three or more figures have to be made for each scene!

Helena Smith Dayton, of New York city, is the original sculptress with the keen sense of humor and the skilful fingers who makes the figures.

Bringing the Steering Wheel Back to Position Automatically

A STABILIZER has been patented by means of which the steering wheel of an automobile can be automatically brought back to its normal position after having been turned. The result is that the steering gear directs the vehicle in a straight line even though the wheel is not gripped.

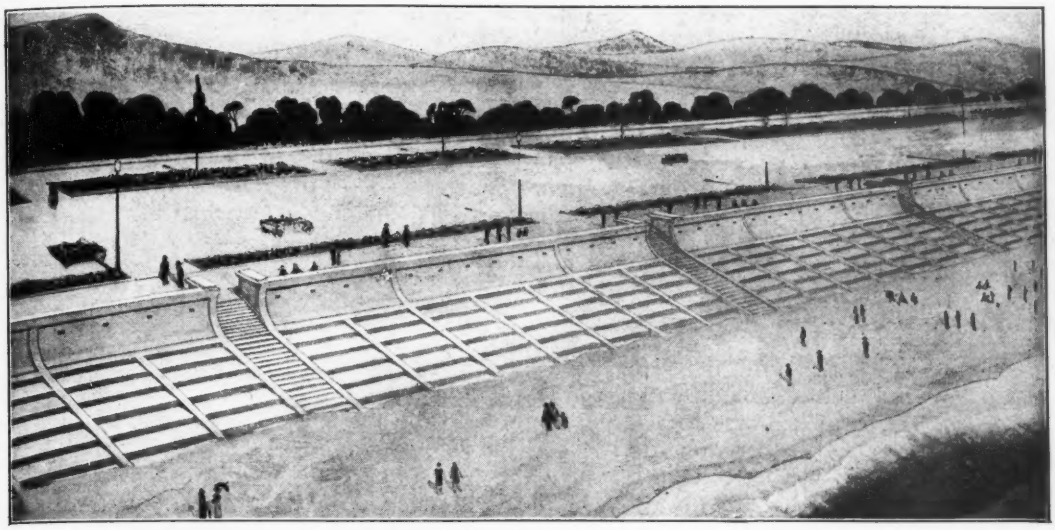
The invention consists of three jointed arms which tend to fold together in a straight line because of the action of two sets of oppositely-wound coil springs placed at the end of one arm and at the joint of the other two. The first set of springs is inclosed in a casing pivoted to a clamp around the stationary steering column, while the free end of the other two arms is rigidly attached to the rim of the steering wheel. As the wheel is turned from its straight-ahead position, the three arms open out against the action of the coil springs, like lazy tongs. Since the springs are oppositely wound, one spring in each set is wound more tightly than the other in the turned position. The two springs wound to the greatest degree will cause the arms to swing back and with them the wheel as soon as the hand pressure is removed.



As the wheel is turned from its straight-ahead position the three arms open like lazy tongs

Fighting the Ocean with a Big Grandstand

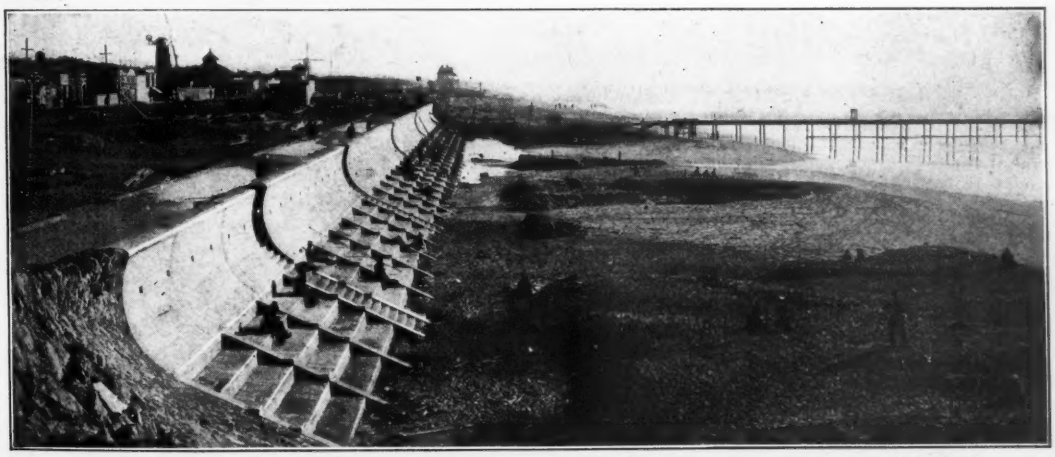
A great beach esplanade has been erected which will provide much needed protection



The bleacher seats, which have a minimum concrete thickness of twelve inches, rest on sand overlaid with eighteen inches of solidly packed clay. At the top is a wide promenade

THE winter storms and equinoctial tides which have caused so much damage to the wide stretch of sandy beach which is San Francisco's pride have received a permanent set-back to their destructiveness. A great esplanade, a kind of glorified grandstand, has been erected which is designed to withstand their attacks. On the ocean side the structure consists of five steps, or bleacher seats, anchored in solid rock. The plane of these bleachers is inclined at about twenty-five degrees to the horizontal. Supporting the bleachers transversely at twenty-foot intervals, except at the stairways, where they are on ten-foot centers, are H-beams twenty by forty-three inches in section and twenty-seven and one half feet long.

From the boulevard or land side the esplanade has the appearance of a massive concrete wall three and one half feet high. The top of the parapet on the ocean side has been made slightly concave, so that as the waves rush up against the wall the water will be thrown back upon itself and will thus lessen the force of the succeeding waves.



The entire mass of concrete is tied together with reinforcing iron in such a way that it is practically a solid fortifying wall twenty-five feet in depth and twenty-seven feet wide

How the Police Help New Yorkers to Protect Themselves

THEATER PROGRAM

Do You Know?

That by street accidents in New York City

One person is killed every 14 hours, and
One person is injured every 23 minutes

You can help to lessen this terrible toll of lives
1. By being careful yourself
2. By teaching others to be careful

Statistics show that the majority of accidents are due to carelessness

We will enforce the rules for drivers, but
Fate must enforce the rules for pedestrians

Reckless drivers are fined and imprisoned
Reckless walkers are maimed and killed

Never cross busy streets except at crossings
Never read newspapers while crossing the street
Never obstruct your view with your umbrella while crossing the street
Always look both ways while crossing the street
Always keep your eyes open and your wits about you

Last month 2344 persons were injured in street accidents in New York City

Ask your policeman for "Safety Booklet."

ARTHUR WOODS,
Police Commissioner.

TEXT BOOK

Do You Know?

I. That by Street Accidents in New York City

One person is killed every 14 hours and
One person is injured every 23 minutes

And

II. That You May be the Next Person Killed or Injured, Unless You Obey these Rules

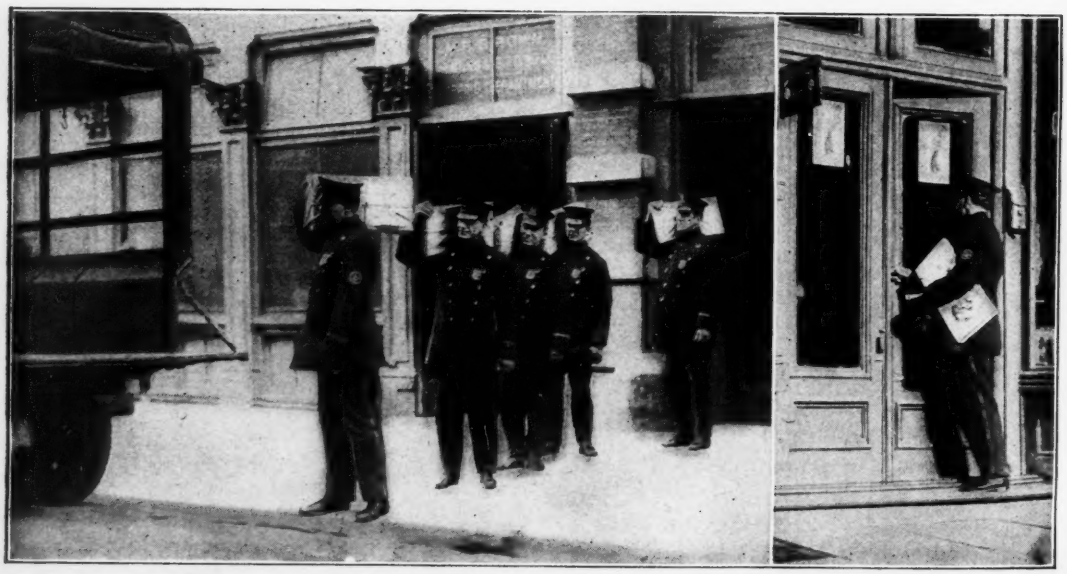
1. Never cross the streets except at crossings.
2. Never hitch behind wagons or automobiles.
3. Do not play games in the middle of the street.
4. Never chase your ball before first seeing that no wagons or automobiles are coming **up or down.** It is better to save your life than your ball.
5. Always keep your eyes open and your wits about you.
6. Be careful, and make your friends be careful too. Save their lives as well as your own.
7. Ask your policeman for "Safety Booklet."

ARTHUR WOODS,
Police Commissioner.

Two kinds of "safety booklets" issued by the New York police to tell the citizen how to protect his life and property. Note that the information is not all of the "don't" kind

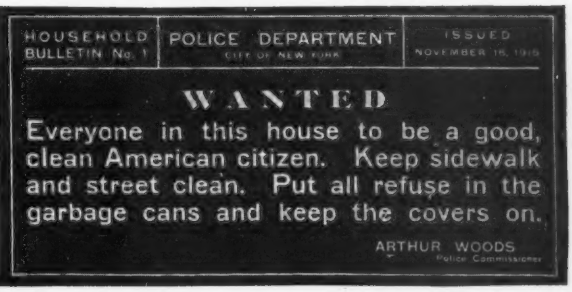
Below: Carrying the bundles of booklets from the printers. Fifty thousand posters, three hundred thousand booklets, and motion picture slides galore have been prepared for the campaign

Below: A policeman entering a shop to place a poster in the window. New York shop windows are literally plastered with these posters of the "help protect yourself" movement



Help Protect Yourself

A great safety movement introduced by the New York police to help the citizen to protect his life and property


HOUSEHOLD BULLETIN No. 1
POLICE DEPARTMENT
CITY OF NEW YORK
ISSUED
NOVEMBER 15, 1915
WANTED
Everyone in this house to be a good, clean American citizen. Keep sidewalk and street clean. Put all refuse in the garbage cans and keep the covers on.
ARTHUR WOODS
Police Commissioner

WE Americans are the most careless people in the world. We preach the doctrine of safety first in the home, follow it up in the office and shop, and then step out on the street and forget all about it. The result is apparent. Last year twenty-two thousand persons were injured and six hundred and fifty killed by street accidents. That means one person killed every fourteen hours and one injured every twenty-three minutes! A pretty record for a people who started the safety-first movement!

Confronted with these figures and aware of the fact that they are increasing with alarming rapidity, the police department of New York City, cooperating with the Advertising Club of New York, has started a campaign to impress upon the people of the greater city the absolute necessity of keeping wide awake against dangers that daily confront them.

The general purpose of the movement is to help the individual citizen to save his life and property. There are rules for those who walk, rules for those who drive automobiles, precautions against burglars, pickpockets and disease, and instruction on miscellaneous subjects.

One of the succinct paragraphs under the heading, "You Who Drive," is: "Your automobile may be under control but how about the other fellow's? He may be a crazy man. You don't know."

Some of the precautions against burglars are:

"When you leave your house don't advertise the fact by pulling down the shades or by leaving a note in the letter-box saying that you will be back at such and such a time. Sneak-thieves profit by such advice. It is an invitation for them to enter.

"When your front-door bell rings and you press the button and no one comes to your apartment, notify the janitor immediately. You may have admitted a thief."

In regard to pickpockets you are advised not to be too eager to pull out your watch and give the time of day to everybody who asks you for it. That's a good opportunity for somebody to grab it and run. Don't show your money in a public place. It is an invitation to criminals to follow, assault and rob you. Don't, when shopping, lay your handbag on counters while looking at goods. This is the opportunity for thieves.

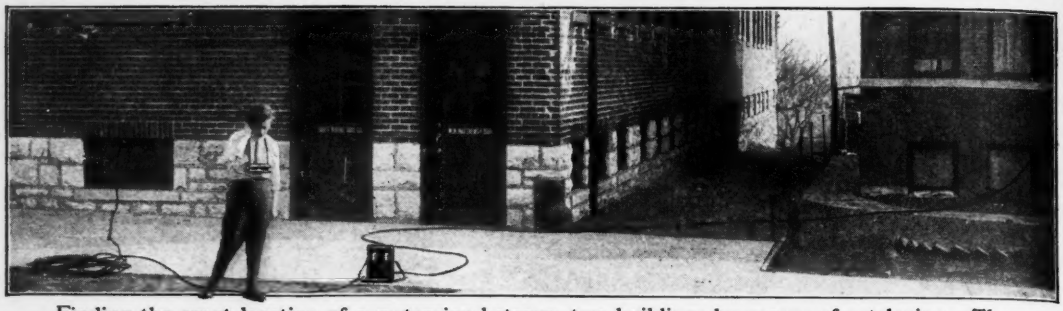
As for disease, respect your neighbor as much as yourself. Don't beat your rugs or stir up ashes so that your dirt will be blown into his apartment to fall on his food or be breathed by him.

If you are well, keep well by helping others.

Buy by standard weight or measure, not by basket or prepared package. The policeman is your friend. Get his advice.

Under miscellaneous information you are asked if you have a good, clear description of your personal property. Could you, if requested, quickly supply a description of each member of your family? Such descriptions are essential if anything serious should happen in your house. Write them in a book.

When you see a crime committed, or observe a suspicious person or condition, notify the police at once. The more you cooperate with the police, the more the police can accomplish for you. Regard the policeman as your best friend. You are paying him to keep your street safe and orderly. He is entitled to your help.



Finding the exact location of a waterpipe between two buildings by means of a telepipe. The electric current is supplied by four dry batteries. The humming of the vibrator is the guide

You Can't See a Pipe Underground, But You Can Hear It

WHAT is a "telepipe?" It is an electrical device that tells you the location of a buried waterpipe, so that no time is wasted in digging over a large area to find it. The instrument is used for locating conduits, cables, I-beams and similar buried objects that are not more than twelve feet below the surface. The photograph shows clearly how it is operated.

The problem was to find the exact location of the waterpipe between the residence and the factory. This was done by attaching the terminals of the telepipe to the faucets in front of each building. This done, the operator with his portable outfit, known as the exploring coil, moved slowly over the area known to contain the pipe, listening with the receiver of the instrument to his ear.

The humming tone of the vibrator was his guide. It was heard all through the area enclosed by the pipes in the circuit, except in one spot, which was directly above the buried pipe.

The current for the instrument is supplied by four dry batteries, and the entire outfit is easily carried. It weighs about twenty pounds.

Its principal advantage lies in the fact that it is very quickly and easily applied and operated, one man being capable of using it alone. When an underground break has occurred and the cellar is in danger of being flooded this feature will be appreciated.

Making a Diving Helmet Out of a Kitchen Boiler

OUT of an ordinary kitchen boiler a Brooklyn engineer has devised a diving helmet which compares favorably with the expensive diver's suit. He took one end of a kitchen boiler and notched it to fit the shoulders. Chains were placed on it to give weight, as shown. With this rig and supplied with air by an ordinary duplex automobile pump, he stayed down fifteen minutes at a depth of thirty feet and completed important emergency work.

There was no window in this boiler helmet. In a later one, however, an oblong glass paperweight cemented to a hole cut in the front of the helmet served as a window. With this rig and a regular deep-sea pump J. J. Grafflin, who devised the apparatus, remained under water nearly two hours at one time.

The air was supplied to this emergency diver's helmet through an ordinary automobile pump

Before Mr. Grafflin hit upon the boiler helmet idea he knocked one head from an empty beer keg and made a diving helmet out of it. To steady the keg and overcome its buoyancy when submerged, a man stood on top, holding to a strip of wood that was nailed to the keg. With this rough outfit a man was able to stay down nearly two minutes at a time. The beer keg led Mr. Grafflin to adopt the kitchen boiler as an efficient diving helmet. Evidently he is a firm believer in the old axiom "Where there's a will there's a way."

Speaking of Styles—Did You Ever Wear the "Mouchoir Tête"?

NEARLY a hundred thousand women and girls over ten years of age in Haiti wear the *mouchoir tête* or headkerchief. This is wound around the head bandanna fashion. On Sundays and special occasions the *foulard* is worn. It is made of silk or of mercerized cotton with brocaded figures woven in it.

The tastes of the Haitian women run the whole gamut of colors. Black is a favorite color of the people, but they are fond of solid reds, yellows, oranges and purples. The principal defect of the colors is that they are not fast colors. A headkerchief and a heavy rain make a sorry sight of any woman in Haiti.

Practically the entire supply of headkerchiefs has come from Europe for many years. The Manchester district supplies the bulk of the cottons, while the others come from Belfast.

We have it now—the soda water fountain in a railway car. Henceforth ice cream sodas will lighten our journeys

The Traveler's Soda Fountain Is an Adjunct to the Dining Car

AMERICAN fondness for soda water has led to the establishment of soda fountains in many foreign places frequented by American travelers. Cities as wide apart as Paris and Havana have set up soda fountains to assuage the national thirst of the American sojourning within their gates.

But here in the United States no effort was made to satisfy the cravings of the traveler temporarily separated from his—or should it be her?—favorite nut sundae dispenser.

A short time ago a clever railroad man, whose first thought is always for the comfort of his passengers, was wondering what his road could do to make its guests forget the tedium of travel. "I have it," he exclaimed, "a soda fountain!" So now when you a-journeying go, you may find yourself in a car in the end of which is a regular soda fountain capable of supplying all sorts of sweet concoctions and soft drinks.

A California Novelty in Street Signs

VENICE, California, has a street sign with possibilities. It marks the corner of Swan Avenue. Instead of carrying the regulation lettering, it is shaped like the bird from which the avenue takes its name and is painted white.

If this idea were extended to other cities we would see a general enlivening of our corners. There would be portrait galleries for such streets as Washington, Madison, Adams, and the like, while symbols could be found readily enough for Cherry, Pearl and Wall Streets. Municipal Art Commissions might pass upon the sign painter's work so that the cherry would not be mistaken for an apple or the swan for a goose.

After viewing the campaign portraits, it is just as well, perhaps, that the project has not been seriously considered.

It would not require a very great knowledge of English to read the name of this avenue

The Most Wonderful of Worlds

Myriads of small particles revolve in rings around Saturn, a giant planet which has ten moons and which is so light that it would float in water

IN the entire visible universe, there is no body so mysterious, so beautiful as Saturn and his marvelous system of rings and planets. But the splendor of Saturn was revealed only to modern times. He became magnificent only after the telescope was invented; for to the naked eye, he appears only as a first magnitude star, revealing nothing of his strange appendages.

It was not only the lack of instruments that withheld the beauty of Saturn from the ancients, but his remoteness as well. The average distance of Saturn from the Sun is about 886,000,000 miles. That enormous orbit around the Sun is traveled in the space of twenty-nine and a half years. In other words, a year on Saturn is the equivalent of twenty-nine and a half of our years. But his day is only ten hours fourteen minutes long. It must not be supposed from this that Saturn is slow. In a single second he covers nearly six miles—a speed far greater than that of a rifle bullet.

Saturn Would Float on Water

Although Saturn is enormously larger than the Earth, he is not nearly so dense. If it were possible to drop Saturn into an inconceivably vast ocean, he would float like so much pine wood. And yet, so enormous is the bulk of Saturn (his diameter at the equator is 75,000 miles) that he weighs more than ninety-five times as much as the Earth.

A dense cloak of clouds envelopes Saturn constantly. What is behind that cloak? No one knows. After an exhaustive study the late Professor Percival Lowell concluded that Saturn's interior was layered like an onion. These various layers rotate at different speeds.

The first man who ever made a study of Saturn through a telescope, first because he invented the telescope, was Galileo. He could hardly believe his eyes when he saw the planet through his feeble instrument. He beheld the ring on edge. As the years went by, what seemed at first two thin arms extending out from each side of the planet, opened. Once in every fifteen years the ring is so tilted that it appears like a mere line. So Galileo had to wait seven and a half years before the ring changed in appearance. He did not know that he was looking at a true ring—so startlingly novel was the sight. He was simply puzzled.

It remained for Huyghens to announce that "the planet is surrounded by a slender flat ring everywhere distinct from its surface." And he was the first astronomer to predict the dates for the vanishing and reappearing of the ring.

The Marvelous Rings are Thousands of Miles Broad

The single ring which the older observers studied has been resolved by modern high-power instruments into three rings—an outer bright ring, an inner bright ring and a dark ring. The dark ring is called the crape ring, because it suggests a veil in texture.

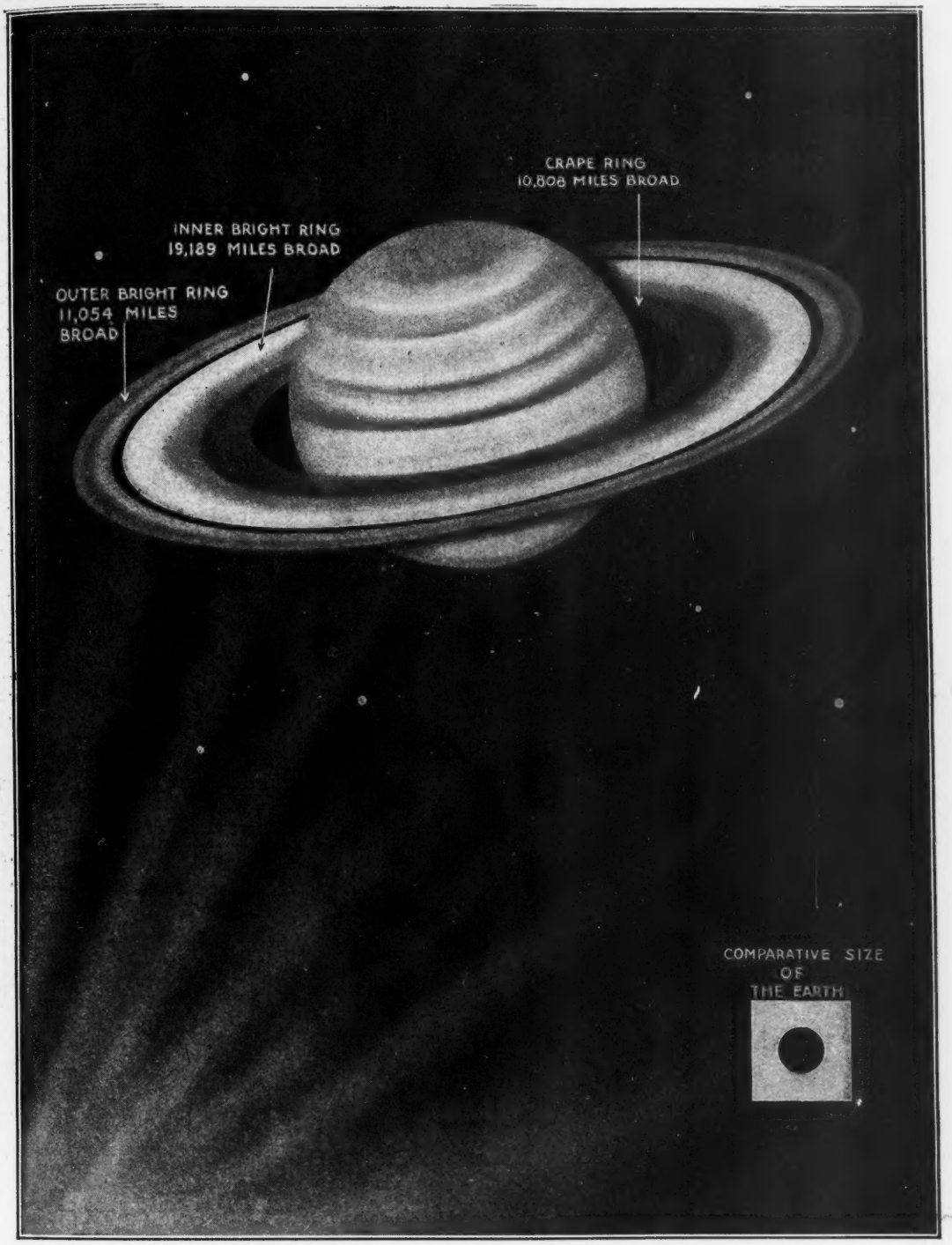
The dimensions of the various rings are given on our drawing by Mr. Scriven Bolton (reproduced from the Illustrated London News and added to by the POPULAR SCIENCE MONTHLY) and are those established by Professor Barnard of Yerkes Observatory. It is altogether probable that if we had more powerful instruments than those at present at our disposal, we would be able to resolve these three rings into still others.

Sir Robert Ball has thus vividly pictured the appearance of ringed Saturn:

"Imagine that you stood on the planet Saturn, near his equator; over your head stretches the ring, which sinks down to the horizon in the east and in the west. The half ring above your horizon would then resemble a mighty arch, with a span of a hundred thousand miles. Every particle of this arch is drawn toward Saturn by gravitation, and if the arch continues to exist, it must do so in obedience to the ordinary mechanical laws which regulate the railway arches with which we are familiar.

"The continuance of these arches depends upon the resistance of the stones forming them to a crushing force. Each stone of an arch is subjected to a vast pressure, but stone is a material capable of resisting such pressure, and the arch remains. The wider the span of the arch, the greater is the pressure to which each stone is exposed. At length

Saturn—A Magnificent Ringed World



From a drawing by Scriven Bolton in the Illustrated London News, with additions by POPULAR SCIENCE MONTHLY

Here we have the most wonderful creation of the visible universe—Saturn and his rings of flying myriads of small particles, attended by his eight largest satellites. Saturn is nine times greater in diameter than the earth. Through a telescope we discern simply a vaporous atmosphere, tormented by an intensely heated core forever hidden from our gaze. Cloud vapor is incessantly shot vertically into the upper atmosphere layers by internal convulsions. The rings are composed of nothing more than a flight of myriads of small particles around their primary, the inner ones revolving in five hours. Each particle, therefore, is a tiny moon

the span is reached which corresponds to a pressure as great as the stones can safely bear, and accordingly we thus find the limiting span over which a single arch of masonry can be extended. Apply these principles to the stupendous arch formed by the ring of Saturn. It can be shown that the pressure on the materials of the arch capable of spanning an abyss of such awful magnitude would be something so enormous that no materials we know of would be capable of bearing it. Were the ring formed of the toughest steel that was ever made, the pressure would be so great that the metal would be squeezed like liquid and the light structure would collapse and fall down on the surface of the planet."

What materials can sustain a stress so stupendous? We must look not for materials, but for force which opposes the attraction of Saturn. This force is the so-called centrifugal force. Sir Robert Ball says: "If we imagine the ring to rotate, the centrifugal force at all points is in an opposite direction to the attractive force, and hence the enormous stress on the ring can be abated and one difficulty can be over come."

What are the Strange Rings?

Mathematicians have studied this problem of Saturn's rings. It is one of the most difficult, most fascinating in all astronomical science. And what is the conclusion of the mathematicians? Simply that each ring is an enormous shoal of extremely minute bodies. "Each of these little bodies pursues an orbit of its own around the planet and is in fact merely a satellite. These bodies are so numerous and so close together that they seem to us to be continuous, and they may be very minute—perhaps not larger than the globules of water found in an ordinary cloud above the surface of the earth, which even at a short distance, seems like a continuous body." Instruments have been devised which show that the mathematicians are right in thus conceiving the structure of Saturn's rings.

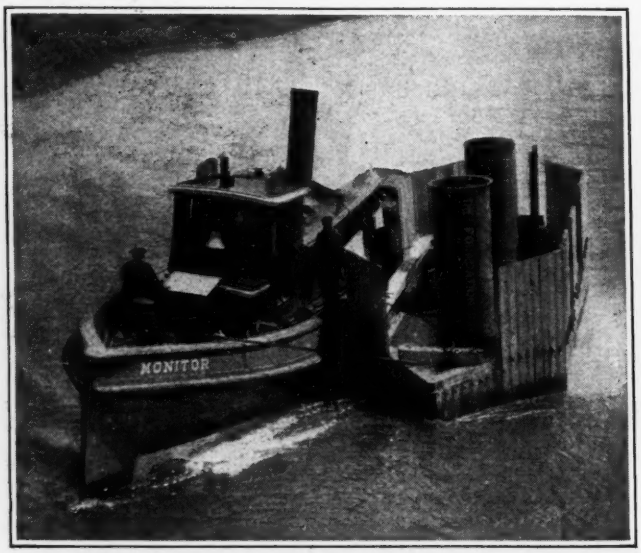
Ten Moons Revolve Around Saturn

Saturn has ten moons. The largest of these is *Titan* which has a diameter of 2,484 miles. Their names in the order in which they are to be found outwardly from the planet are *Mimas*, *Enzeladus*, *Tethys*, *Dione*, *Thea*, *Titan*, *Themis*, *Hyperion*, *Japetus* and *Phoebe*. Two of the moons are so small that they cannot be seen through the telescope at all. Only on the photographic plate are they visible.

Our cover picture, based on a drawing by Morell, the astronomical artist, shows the wonderful ring system as it would appear in the most powerful telescopes. For the sake of effect, he has, as it were, taken his stand upon *Japetus*, the only one of Saturn's ten moons from which this view could be obtained. The other satellites keep strictly to the plane of the ring. *Japetus* itself—which is apparently the size of our moon but is ten times farther from the parent body—is remarkable for the variability of its light, which suggests the presence of an atmosphere and the formation of clouds. Proctor and other astronomers even believed that it might be the abode of living creatures, but that view is not shared by astronomers of our time.

Floating a River Caisson Into Position for Sinking

RIVER caissons which act as bridge or pier supports are usually built either on the shore and skidded or launched into the river, or else they are built on a pontoon, made of two or more parts bolted together, as the accompanying photograph shows. When the caisson has been placed in the correct position for sinking, the pontoon is unbolted and flooded, which allows the caisson to float into position.

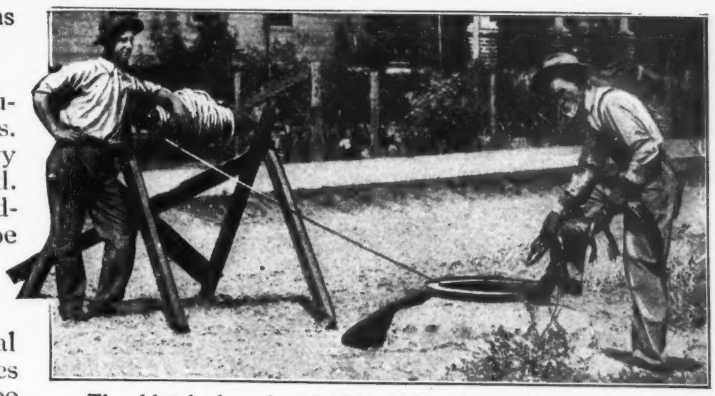


Caissons built on a pontoon on which they are carried to the desired location and floated into position

The City Alligator. He Cleans the Sewers of Fort Meade, Florida

THE alligator has graduated into the useful class. At last his sluggish energy has been usefully directed.

Recently a six-hundred-foot, twelve-inch sewer pipe in Fort Meade, Florida, became clogged with sand and dirt. According to the "Engineering Record" several sewer-cleaning contrivances were used and about $1,500 was spent, but to no avail. The pipe remained clogged as before. At this juncture the superintendent of water and sewers secured a small alligator, to which he fastened a rope. The 'gator was lowered into the pipe. After a struggle in the unsavory environment he reached the next manhole, dragging the rope after him. When he had traveled one section of the pipe, the rope, to the middle of which knotted chains were attached, was pulled back and forth and the obstructions removed.



The blotched and wrinkled hide of a living, squirming alligator makes a most efficient sewer-cleaning apparatus

Following this success, other alligators were used, until at the present time ten are employed for cleaning sewers. They are doing what skilled workmen equipped with modern apparatus have failed to do.

Grocery Store on Wheels Serves Large Rural Territories

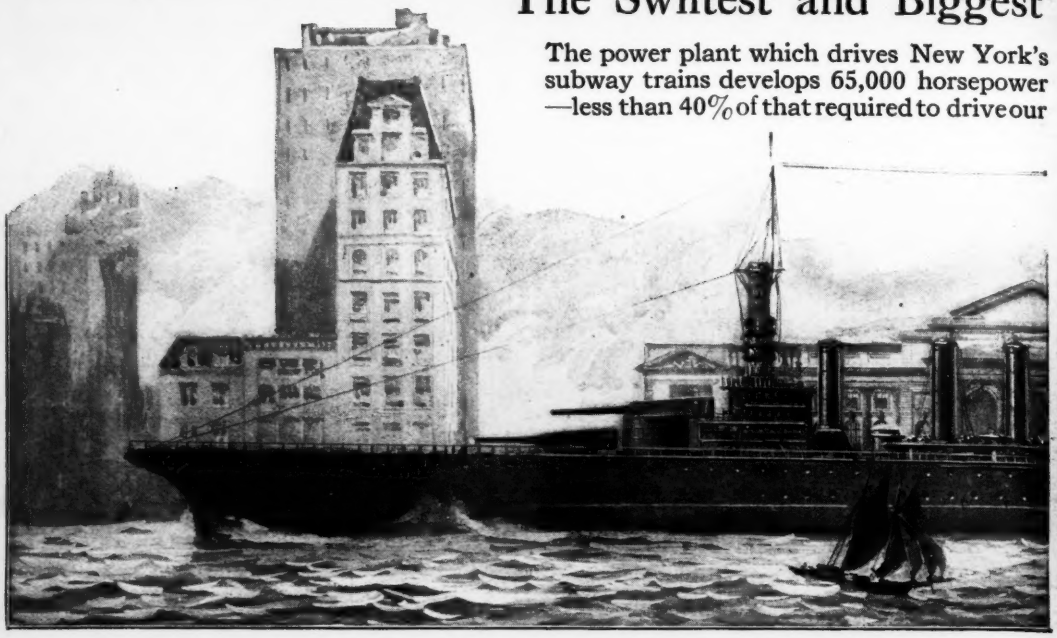
THE progressive merchandizing methods of to-day made possible by the proper utilization of the motor truck are well illustrated in the two accompanying views which picture a complete grocery store on wheels. The vehicle serves a large rural territory where the homes of the farmers are at considerable distance from the town store. It makes more than a hundred stops per day serving its customers with a complete stock of groceries, green goods, meats and candies.

The interior of the store is electrically lighted and heated from the exhaust gases of the motor in winter time. Beneath the body at the rear are two chicken coops with hinged swing-back bottoms for live poultry.

The interior of the grocery car with its snow-white bins and spotless counters

The Swiftest and Biggest

The power plant which drives New York's subway trains develops 65,000 horsepower —less than 40% of that required to drive our

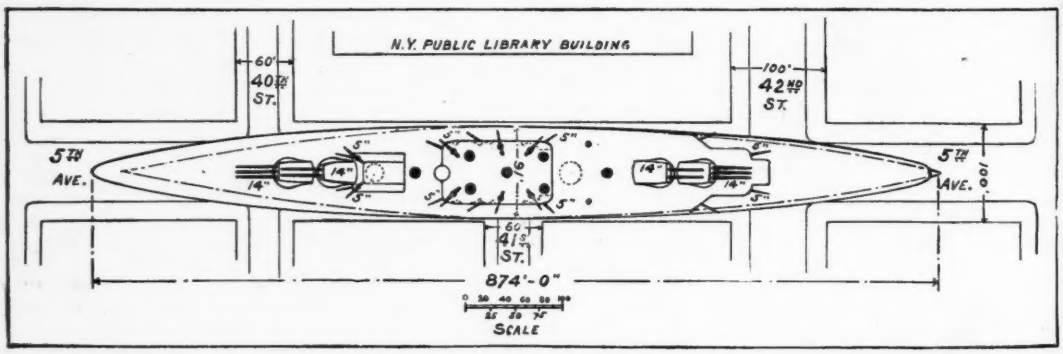


Our new battleships are the most daring ever proposed. They will have a length of 850 feet between perpendiculars and an over-all length of 874 feet. What that means is shown by the

A FEW months ago the United States Navy Department announced that it would build battle cruisers with a length of 850 feet and a speed of thirty-five knots—forty miles an hour. Only shipbuilders and naval officers realized the full meaning of the Department's program. England is said to have completed battleships of about the same size but never have we attempted to build a fighting vessel so huge. The battles fought by the British and German fleets in the North Sea were object lessons. They showed that sea fights are won by speed and hitting power. And so the Navy Department determined to build the fastest battle-cruisers and to arm them with the most powerful guns.

What is a battle cruiser? It is a ship which is faster than a superdreadnought, but not so heavily armored. Battle cruisers were lost in the last North Sea battle largely because they had not the protection of a superdreadnought. But although they went down, they saved the day for England. They kept the German fleet in action, until the British Grand Fleet with its superdreadnoughts could appear on the scene. And so we decide that battle cruisers we must have.

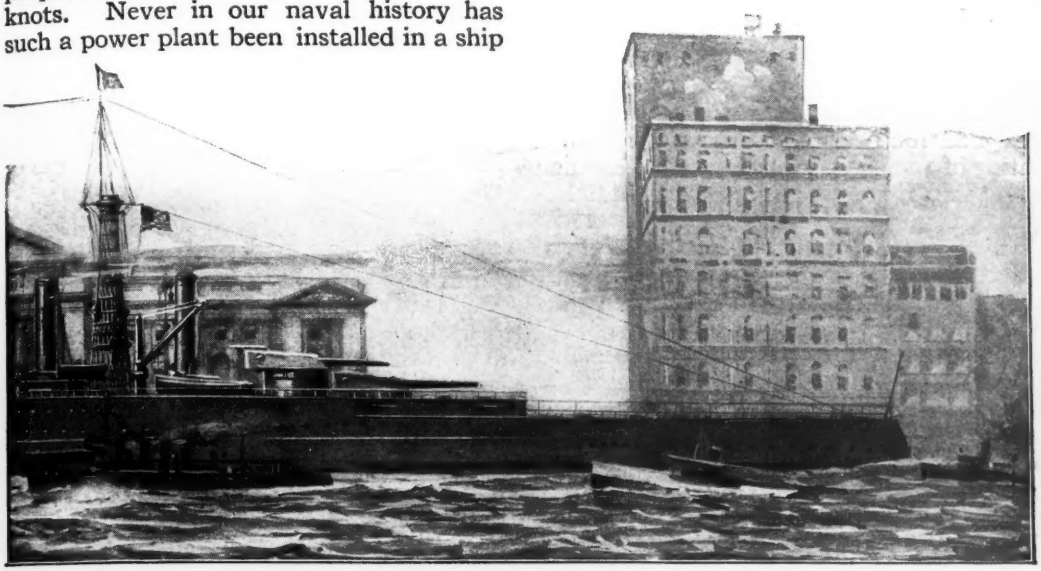
It is one thing to design a battle cruiser 850 feet long with a speed of thirty-five knots; quite another to build it. It would seem simple enough to magnify existing models and to put in bigger engines. That



Comparison between the proposed cruiser and New York city streets. These cruisers will have ten fourteen-inch, twenty five-inch and four three-inch anti-air-craft guns besides eight torpedo-tubes

Battle Cruisers in the World

proposed battle cruisers at a speed of 35 knots. Never in our naval history has such a power plant been installed in a ship



comparison with New York's Public Library and adjacent Fifth Avenue buildings in this picture. They will cost $16,500,000 each. It will take 180,000 horsepower to drive one at 35 knots

is not the way ships are built. The *Lusitania* made twenty-five knots with 70,000 horsepower. To make fifty knots, it might be supposed that it would be necessary merely to double the size of the engines. Battle cruiser building would be easy if that were all. Each additional knot is purchased at the expenditure of thousands of horsepower. Our naval engineers estimate that 180,000 horsepower will be required to develop thirty-five knots in one of the new battle cruisers. Never have marine engines of that power been built. As a result, American shipbuilding companies are loath to bid on the cruisers. The builders say that they will not bid except with the understanding that they will receive the cost of building plus ten percent. A similar plan of paying for ships was worked out in Germany when the giants *Imperator* and *Vaterland* were built. The Naval Appropriation Act of Aug. 29, 1916, permits this method of bidding. Our shipbuilders maintain that even on the ten-percent-plus-cost basis they will probably be losers because the Government will undoubtedly copy their successful models, and build ships in its own yards after the hard work has been done in private yards.

To develop a speed of thirty-five knots—forty miles—an hour, turbines must be employed. A steam turbine works on the windmill principle. Steam spurts against blades on a long shaft. The old-fashioned steam engine—"reciprocating engine" in engineers' language—is very tall. Its pistons work up and down in the cylinders, as everyone knows. Reciprocating engines take up much space, so much, in fact, that a ship like the *Lusitania*, which was driven by them, was practically all engines. The steam turbine requires very little head room and very little floor space, so that great economies can thus be effected. Moreover, oil will be used as fuel, which can be carried in the double bottom of the cruiser, thus further releasing space which would otherwise have to be taken up by coal bunkers. Moreover, steam turbines are lighter than reciprocating engines. They can be heavily overloaded, should emergency arise.

On the other hand, the use of steam turbines is not all plain sailing; for turbine engines, unlike reciprocating engines, are non-reversible and special means must be provided for backing. Furthermore, the most efficient speed of revolution of a boat's propeller is very much lower than the most efficient speed of the shaft of a turbine engine. Therefore it is not the most efficient proceeding to couple the turbine directly to the propeller-shaft. Gearing and a novel method of driving

electrically with turbine engines will probably be employed on the new vessels.

The British battleship *Queen Elizabeth*, which took a prominent part in the Dardanelles campaign, has a rating of 60,000 horsepower and is a twenty-five-knot vessel. The British *Tiger* was designed for a speed of 28 knots with a rating of 100,000 horsepower. The German battleship *Goeben*, which made her famous dash for Turkey at the beginning of the war, is a twenty-eight-knot vessel of 70,000 horsepower, while among the later vessels the *Seydlitz* might be mentioned as a twenty-nine knot, 100,000 horsepower vessel. The *Vaterland*, most impressive of the German steamers now resting in New York harbor, has a horsepower rating of 65,000 and a speed of twenty-four knots.

The great Waterside station of the New York Edison Co., located on the East River, is reputed to be the largest steam plant in the world. Two buildings comprise this station. No. 1, the original station, has a total capacity of about 165,000 horsepower, which is considerably less than the power of one of the new battle cruisers. The two buildings of the Waterside plant develop about 288,000 horsepower, which is about 60 per cent more power than one of the new battle cruisers will develop.

The great 59th Street plant of the Interborough Rapid Transit Co., which supplies power for the trains of New York's subway, develops only a little over 65,000 horsepower—less than forty per cent of that of the proposed battle cruiser.

In 1900 the total hydro-electric power developed in the United States was little more than enough to run one of the new battle cruisers, amounting to about 200,000 horsepower. To-day the total horsepower developed hydro-electrically in this country would run about ten of the battle cruisers.

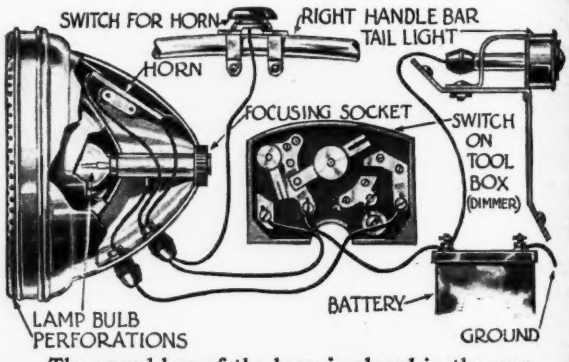
The greatest hydro-electric development of all, that at Niagara Falls, is perhaps the most impressive subject of all for comparative purposes. The mean flow of the Niagara River is about 222,000 cubic feet per second and the fall is 160 feet. The power houses planned for both American and Canadian sides of the Falls, including those in operation, are expected to utilize twenty-one and a half per cent of the mean flow of the river, utilizing a total of 650,000 horsepower. This vast amount of power would be insufficient to run even four of our new battle cruisers.

The motorcycle has many necessary accessories to carry so that a combination lamp and horn arrangement fastened to the handlebar saves valuable space

---

Turning Your Motorcycle Lamp into a Horn Without Changing Its Shape

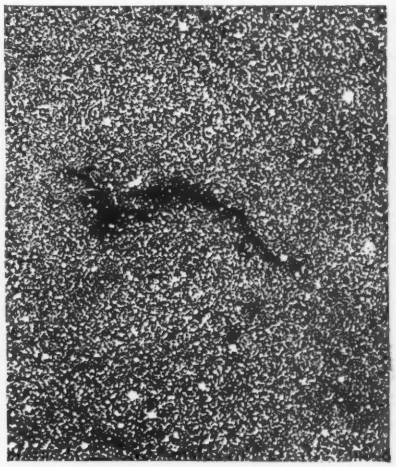
A COMBINED lamp and horn which does not detract from the original lines of the motor vehicle has been invented by Nathaniel B. Wales, of Boston, Mass. He combines in a single unit both the lamp and horn. The electromagnets of the sound producer are mounted in a rear extension of the lamp case without changing its size or shape. Immediately in front of the sound producer is the electric light bulb. For a megaphone or sound chamber to intensify the volume of sound the inventor utilizes the hood, which frequently serves on gas lamps for the escape of heat. In other words, the wall adjacent to the parabolic reflector becomes the sound chamber. Obviously, it is not necessary to change the size of the lamp to do this. If this does not insure a sufficient volume of sound the circular front of the lens case may be utilized.



The sound-box of the horn is placed in the rear extension of the lamp case. The hood acts as a megaphone to intensify the volume of sound

Is Space All Aglow?

The new startling theory advanced by Professor Barnard to explain non-luminous bodies brought out in relief against the sky



The photograph on the left is a luminous nebula which is a mass of gas. But what is the curious irregular hole among the stars in the photograph on the right? These black holes are supposed to be openings in the rich regions of the stars. Professor Barnard is inclined to the belief that the supposed holes are feebly luminous bodies, and that they were once bright like the nebula shown at the left, but have lost their light and become blackened with age

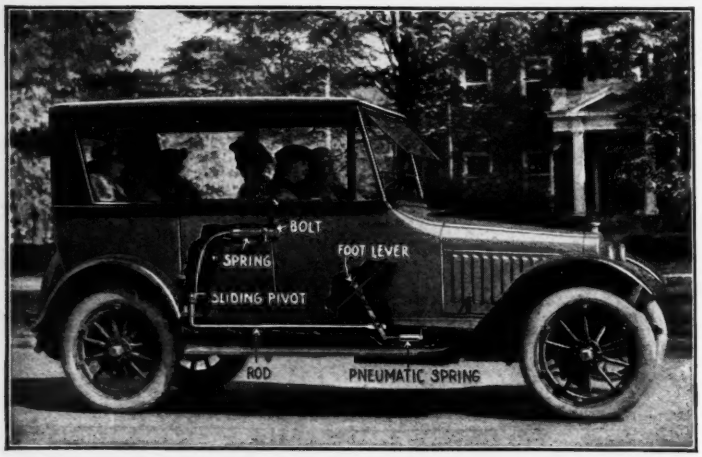
THERE is coming to the front the consideration of the dark spots in the sky. Professor Barnard of the Yerkes Observatory has been studying this side of the question lately, and the results that he has already obtained lead him to speculations that are both new and interesting.

The nebulae of the sky have generally been considered to be intensely hot. These huge masses of luminous gas would cool and contract until, after millions of years, the more compact stars were formed. The stars might cool further until no light could be seen coming from them; but it was not generally believed that the gases of the nebulae themselves could cool and still remain in the gaseous state. One of the first results of Professor Barnard's work, however, was to lead him to believe differently. Let us follow him through his reasoning.

He says that in photographing the sky, large dark markings have often been noticed in the photographs. At first blush they seem merely huge openings in the rich region of stars through which one looks out into the blackness of the space beyond. Although there are undoubtedly such vacancies, the more one becomes familiar with others of them, the less this explanation appeals.

To suggest the true explanation, Professor Barnard has prepared the pair of photographs appearing on this page. These, he explains, have been made exactly to the same scale, and a striking resemblance is seen between the two objects that stand out in them. But one is an ordinary luminous nebula, and the other is a dark—what? His observations induce him to believe that it, too, is a nebula, but one in which the great mass of gas has finally cooled and lost its light. The gas of the nebula, like many others that Professor Barnard has studied, is still dense enough to take definite outline and to stand out against the luminous background behind.

But right at this point we would be led to still another conclusion. There are dark spots having very definite outlines to be seen in the heavens, where, there is every evidence to believe, there are neither luminous stars nor luminous nebulae to light up a background for them. What then, is the cause for the luminous background in such cases? There seems to be but one possible explanation, and that is that space itself is luminous. Space itself might be filled with the feeblest luminosity, so feeble, indeed, that at the tremendous distances to the fixed stars it is not even perceptible to sight. Then, as space is supposed to be of infinite extent, this luminosity will increase in apparent density until, finally, it would become dense enough to affect a sensitive photographic plate. Only in this way would it be possible to explain how non-luminous objects could be brought out in relief in these parts of the sky.



By pressing the foot-lever the door opens. By the use of branched rods under the car both doors may be opened at once

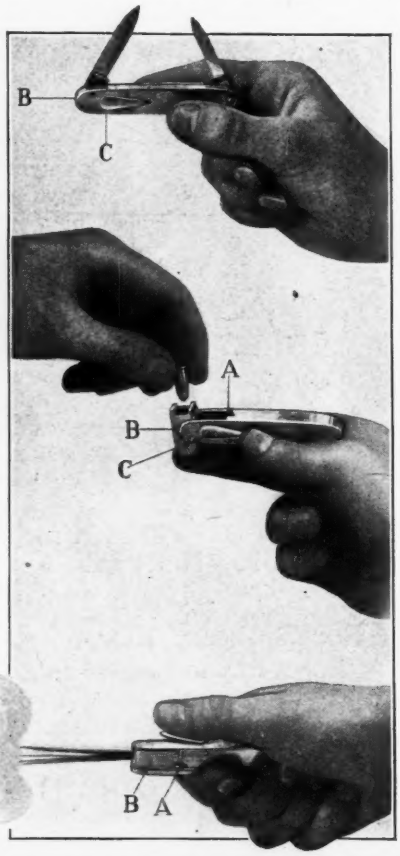
Automobile Doors May Be Opened from the Driver's Seat

REMAINING in his seat, the driver of any two-seated automobile may unlock and open the rear or tonneau doors with his foot, provided the doors are fitted with the simple device shown in the accompanying illustration. This consists of a bevel-ended snap bolt holding each door closed by means of a coil spring, the rear end of the bolt having a pin working in a slot in a downwardly-curved bar positioned in a curved recess between the inside and outside of the door. The rear end of the bar is connected with the rear end of a long rod beneath the car body and bent up through a slot in the floor. The forward end of this rod is attached to the lower end of a lever pivoted to the floor of the driver's cab, the upper end carrying a pedal. A dash-pot preferably of the pneumatic type, is carried ahead of the lever and connected with its lower extremity.

A push on the pedal causes the rod under the car to be moved toward the rear and with it the curved bar and the snap bolt, thus unlocking the door. When the pressure on the pedal is released, the dash-pot on the pedal lever forces the door to close and lock automatically. One device can be used to open either side door alone or both doors simultaneously. Each door is provided with a knob on the snap bolt to open it from the rear seat independently of the foot operated device.

Shoot the Robber with Your Pen-Knife Revolver

A POCKET knife which has two blades and an attachment that enables it to discharge a twenty-two caliber short cartridge, either blank or ball, is one of the latest novelties to be placed on the market. It is said to be practically as effective as a regular twenty-two caliber revolver of the short barrel type. It is three inches long and one-half inch wide.



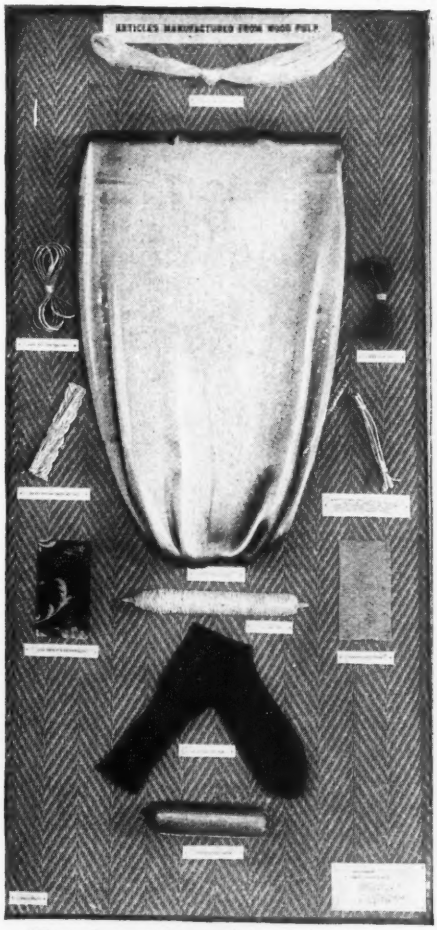
A—Latch. B—Barrel. C—Trigger. The thumb operates the trigger

You hold the revolver in your right hand with the back edge up. You pull back a little latch on the back of the knife, and at the same time the barrel is tilted forward and opened with the left forefinger. Then you insert the cartridge and latch the barrel securely. The trigger is placed on the side of the knife in a raised position, ready for firing. You hold the knife in your right hand with the end of the right thumb on top of the trigger. Press the trigger down quickly and the cartridge is exploded. It is aimed in the same way as any ordinary revolver.

Will We Dress in Paper Clothes?

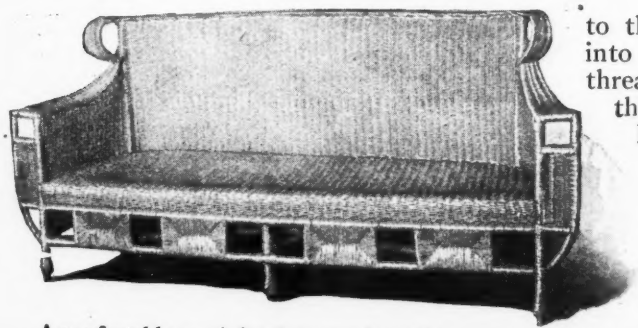
They make socks, chairs and twine out of paper now, and you can't tell the difference between them and the usual product

IN the good old days of plenty, how lavishly we used that imposing natural resource of ours, the great American forests. We cut down tree after tree without taking the slightest measures for replanting them. When we floated the trees to our saw mills we cut one-third of them into lumber and we threw the rest away. But finally, when we could not help but see that our forests were nearing depletion, we established the Forest Service to determine what could be done! And ever since that time we have learned a host of amazing things about lumber and the uses of lumber waste. But who would have expected as a result that some day we would be making such things as artificial silks from such materials as sawdust? Yet that is exactly what is being done. Lumber waste that was once considered worthless is now mixed with small quantities of wood pulp, made into paper, sometimes mixed with cotton or woolen fleece, and then spun into "silk" neckties and "silk" socks. And, as the accompanying photographs amply show, these are not the only commodities that are being so made with success. It is already a matter of economy to manufacture articles from spun paper which range in diversity from furniture and rugs to suitcases and flour bags.



These interesting articles were all made from wood pulp. They represent all varieties and grades of paper "silk"

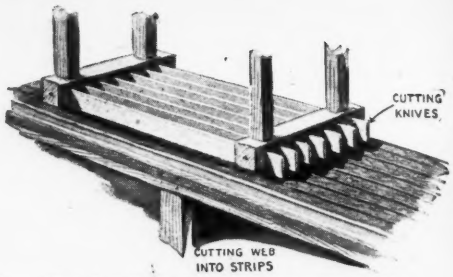
Equally as interesting is the manner in which the paper is spun into twine and into thread. In a process for making twine, the paper is first cut into long strips about one inch wide. These strips are then passed through a machine which corrugates them in the direction of their lengths. These are then twisted by hand into the shape of twine, as the illustration shows. The twine is finally reduced to the proper diameter by feeding it into other machines which wind the thread up very tightly. A process of this kind is used for making the larger size twines and ropes, and for heavy cables for towing ships.



A comfortable couch for the veranda or the summer cottage. It is made from spun paper reeds woven over a rattan and wood frame. It is as durable as it is attractive

For spinning the fine twines that are used for wrapping bundles and for binding harvested grain, a slightly different method is used. Narrow strips of the paper are wound up in the form of a disk. The inner edge of the paper disk is then pulled out, and

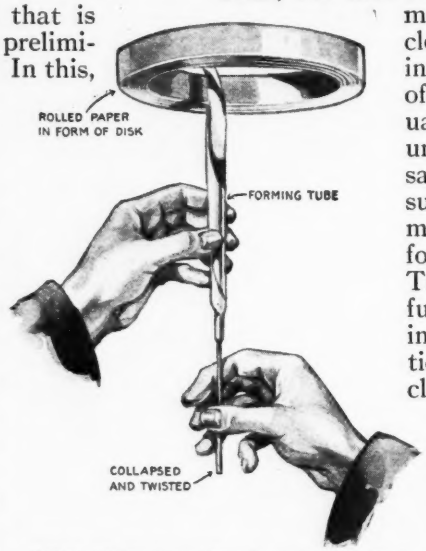
The paper strip is corrugated in uniform lines and is then grasped firmly and twisted into a string



Cutting the web into long narrow strips after it has been compressed into duplex form, preparatory to twisting

the elongated helix so formed is further hand-twisted into a very thin tube. This tube is then further collapsed and twisted until a strong tightly-wound string is obtained.

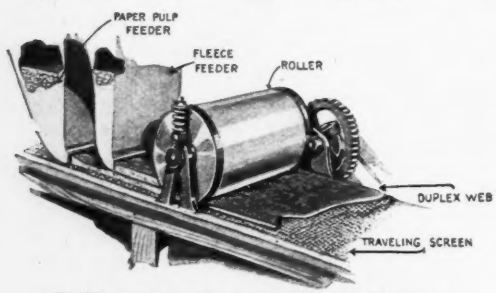
For making the thread that is used in clothing, another preliminary process must be used. In this, a wide sheet of moistened wood pulp is fed into a compression-roller under another sheet of either cotton or woolen fleece of the same width. Both sheets are quite soft, so that after they have been forced through the heavy rollers, they will come out with their fibers interengaged and in the form of one solid web. The duplex web so formed is then placed in a cutting machine and divided into long narrow strips. These may then be hand-twisted and spun in a manner similar to that used in making the finer twines described above.



Method of strengthening paper twine having a fibrous core. The paper ribbon is first curled around the core

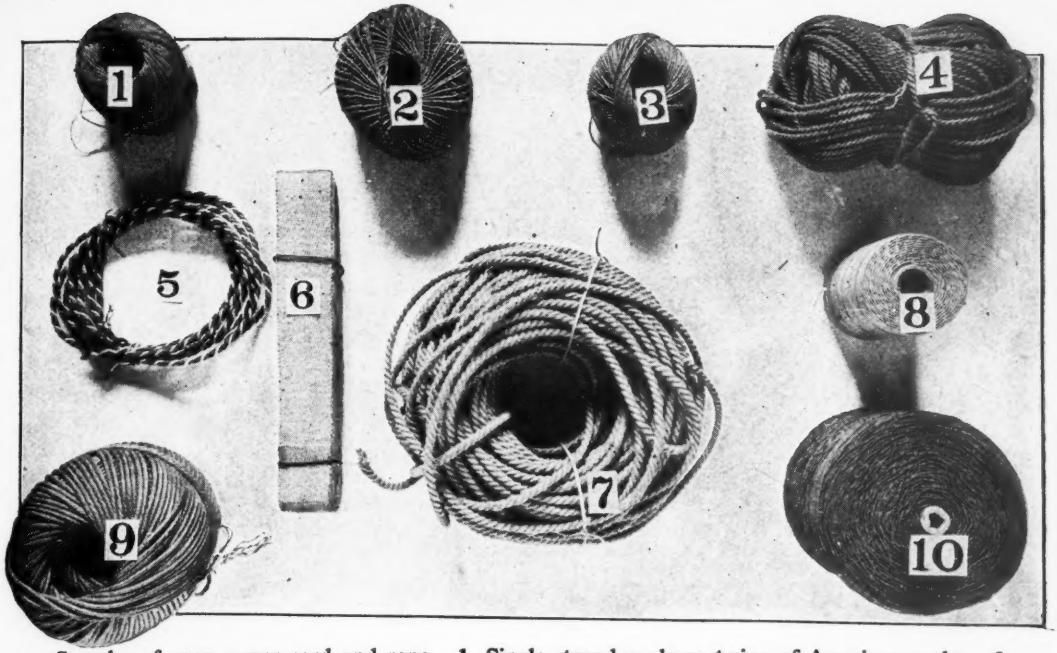
The finished thread is then woven into cloth in any of the ways in which ordinary thread is woven. But because of its different nature, the cloth that is made from spun paper may be beneficently treated in ways which can not be used with the ordinary cotton or woolen cloths. Thus, the first treatment consists in immersing the paper-spun cloth in great vats containing solutions of emulsions of fat. The cloth will gradually absorb the grease until it has become well saturated with it. The result is that the cloth is made water-proof and its former stiffness is removed. The cloth is then still further improved by treating it in antiseptic solutions. These will make the cloth both air-tight and sanitary. Being now both moisture and air-proof, the cloth is exceedingly warm since the radiation of the heat from the body is prevented by this treatment to a very large extent.

By processes which are based upon the ones that



Rolling the pulp to compress it into a duplex web, which is the first stage in the preparation of the paper strips

This thread has a surrounding covering of fleece securely united to the paper portion. It is twisted into a felt-like fabric

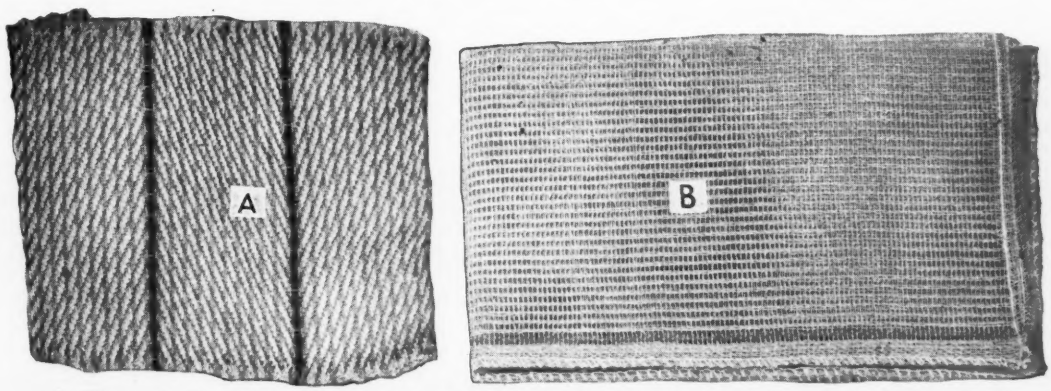


Samples of spun paper cord and rope. 1. Single strand package twine of American make. 2. Package twine of Swedish make. 3. Same as No. 1, medium weight. 4. Cable clothesline (Swedish). 5. Variegated skipping rope. 6. Horse blanket webbing. 7. Three-strand rope. 8. Same as No. 1. 9. Heavy package twine. 10. Single strand package twine (Swedish).

have just been described, a host of other woven materials that are made from paper thread are being successfully manufactured. These include such important commodities as artificial linens and leathers. Traveling-bags and suitcases made from artificial leather are now selling for five and six dollars apiece. Other types of matting which are made by similar processes but which employ different mixtures of paper thread, serve a diversity of uses.

Thus paper mattings are taking the place of burlap wallpapers; they are serving as backing for linoleums and oilcloths, and they are being used in great quantities in the making of fancy paper novelties. And these facts become all the more amazing when we consider that the entire spun-paper industry is but a few years old.

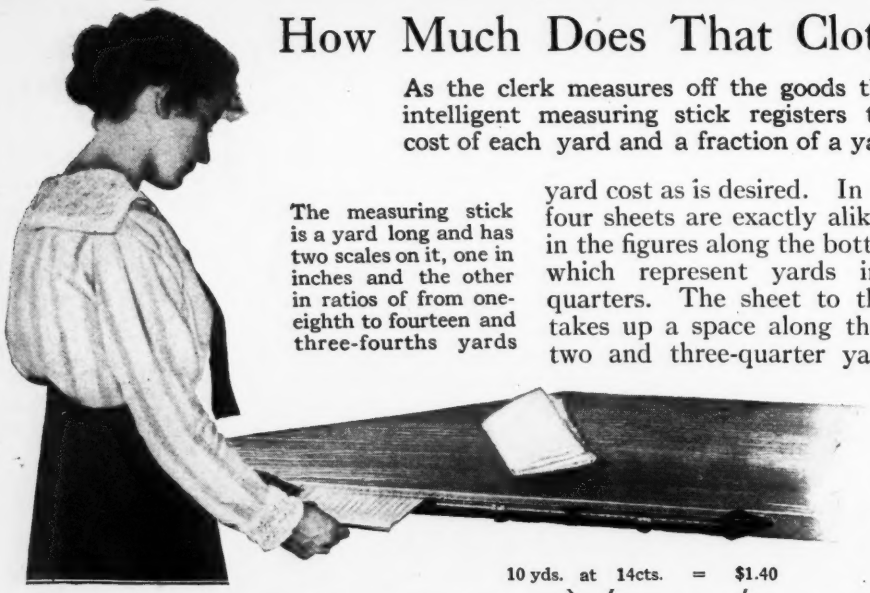
By far the most astonishing progress, however, has been made in the substitution of spun paper for expensive cotton and flax in the making of artificial linen. The United States is not alone in this, however. Germany and Austria are now using spun paper far more extensively than are we; in fact, their use of it has enabled them to solve many of their war problems.



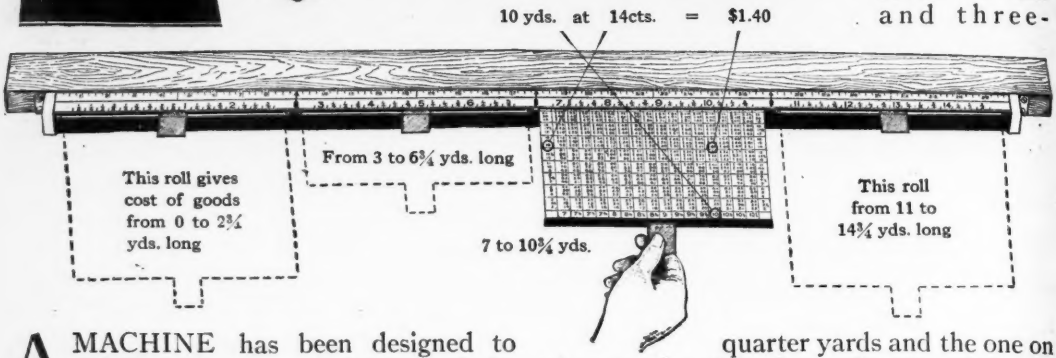
A. Heavy closely woven three-strand paper burlap used for bags and bagging. B. A single-strand, open-weave paper onion bag, reinforced and edged with paper pulp and sewed with cotton

How Much Does That Cloth Cost?

As the clerk measures off the goods this intelligent measuring stick registers the cost of each yard and a fraction of a yard



The measuring stick is a yard long and has two scales on it, one in inches and the other in ratios of from one-eighth to fourteen and three-fourths yards


10 yds. at 14cts. = $1.40
This roll gives cost of goods from 0 to 2¾ yds. long
From 3 to 6¾ yds. long
7 to 10¾ yds.
This roll from 11 to 14¾ yds. long

A MACHINE has been designed to eliminate losses made by store clerks in over measuring and in calculating the cost of fractional yards. It consists of two main parts—a measuring stick attached to the edge of the counter and a series of four rolls of paper with sets of figures on them. These rolls of paper are spring-operated.

The measuring stick is just one yard long. It has two scales on it. That nearest the edge of the counter is in inches, running from zero to thirty-six inches or one yard. The other scale is laid off on the edge of the stick farthest away from the counter edge. It takes up almost thirty-six inches, but it is laid off to a certain scale or ratio to represent from one-eighth to fourteen and three-quarter yards. This scale is divided into four equal parts as indicated by the arrows. One of the rolls of paper mentioned is fitted between each of the arrows.

Each roll surface is divided off into a series of rectangles with figures in each. The figures in the left and right border rectangles of each sheet or roll represent the cost of the goods in cents, beginning with two cents and going up to as high a yard cost as is desired. In this respect the four sheets are exactly alike. They differ in the figures along the bottom of the sheet which represent yards in fractions of quarters. The sheet to the extreme left takes up a space along the ratio scale of two and three-quarter yards. The next sheet or roll takes up from three to six and three-quarter yards; the one next that from seven to ten and three-quarter yards and the one on the extreme right from eleven to fourteen and three-quarter yards. The figures along the bottom of each sheet correspond with the yardage of the ratio scale. The figures in the rectangles, between the side and bottom figures, represent the cost of the goods in dollars and cents. Each cost figure is the multiplication of the bottom figure by that of the cost per yard on the same level line as the final cost.

The clerk measures off the goods a yard at a time. If the purchase is ten yards, the third roll is pulled out from the left. If the goods costs fourteen cents a yard, the figure fourteen is found in the left-hand border column, reading across to the right until the clerk comes to the vertical column with the figure 10 at the bottom. Then the cost is found to be $1.40. Other fractional yards and fractional cents purchases are found in the same easy manner.

There are stops at each end of the measuring stick to prevent the clerk from measuring more than a yard at a time. The rolls of paper pull out and roll up again like ordinary roller shades.

Could You Pass This Examination?

It is the one given by a street railway company to applicants for the positions of motormen and conductors. It is harder than it seems at a casual glance

APPLICANTS for positions on the Dallas street railways are scientifically selected. The purpose is to secure the quickest thinkers and those most capable of obeying orders. According to P. W. Gerhardt, superintendent of transportation, the question of accident prevention rests with the man on the car. Fool-proof equipment, safety first campaigns, lectures, contests and prizes all do their part toward the reduction of accidents, but, according to Mr. Gerhardt, it is the man behind the controller that really counts.

Prospective employees are given three tests, respectively, attention test, observation test and judgment test. In the accompanying illustration the printed question blank used in the attention test is shown. Questions one and two are in the way of catch questions and require the closest attention of the applicant. Questions three, four, five and six are arithmetical questions. The applicant is timed with a stop watch to determine how long he takes to answer the questions, and the number of omissions and errors are counted. The test is given but once, as its effectiveness depends wholly upon its novelty. The object is to determine the applicant's ability to receive instructions, and to do as he is told to do.

ATTENTION TEST

GENERAL DIRECTIONS:

Do what the printed instructions tell you to do.
Do not ask the examiner any questions about the examination.
Do not ask any other person who is taking the examination any question or watch any one to see what he does.
Work as rapidly as you can WITHOUT MAKING ANY MISTAKES.

1. Write your name and permanent address here.

.....

.....

2. Do what it says to do as quickly as you can, but be careful to notice just what it does say.

With your pencil make a dot over any one of these letters, F G H I J, and a cross after the longest of these three words: BOY, MOTHER, GIRL. Then, if Christmas comes in March, make a cross right here .....but if not, pass along to the next question and tell where the sun rises.....If you believe Edison discovered America, cross out what you just wrote, but if it was some one else, put in a number to complete this sentence: "A Horse has.....feet." Write YES, no matter whether China is in Africa or not.....and then give a wrong answer to this question: "How many days are there in a week?.....Write any letter except G in this space.....and then write NO if 2 times 5 are 10.....Now, if Tuesday comes after Monday, make two crosses here.....; but if not, make a circle here.....or else a square here..... Be sure to make three crosses between these two names of boys: George.....Henry. Notice these two numbers, 8.5. If iron is heavier than water, write the larger number here.....But if iron is lighter, write the smaller here..... Show by a cross when the nights are longer: In summer?.....in winter?..... Give the correct answer to this question: "Does water run uphill?.....and repeat your answer here..... Do nothing here (5 plus 7 equals..... unless you skipped the last question; but write the first letter of your first name and last letter of your last name at the ends of this line.....

3. Add the following as indicated:

63429	34321	76005	57333	62491	78845	10001	27345
19587	19358	19008	58888	66647	10002	99009	15493

4. Subtract the following as indicated:

98563	56321	98765	76543	79989	80001	90990	76598
89647	10057	56789	56539	78890	71000	10009	35873

5. Multiply the following as indicated:

38764	78692	98976	53002	41999	59117	41009	35873
5	3	17	5	8	9	4	6

6. Set down and add the following:

Five hundred and fifty-three dollars and five cents.
One hundred and ninety-nine dollars and four cents.
Two thousand and three dollars.
Two thousand seven hundred and forty dollars and ninety-one cents.

Test blank used in determining the eligibility of an applicant, and his ability to do exactly as he is told without hesitancy

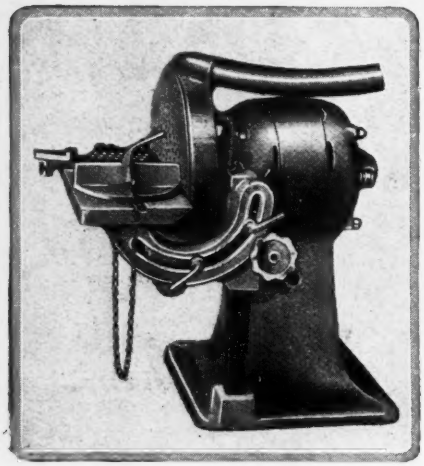
But long before the applicant comes to the attention test he is put through other tests he does not know about. Says Mr. Gerhardt:

"All applicants are eliminated who are in any wise crippled, or deformed, or who are repulsive in appearance, dirty or slovenly in their dress, or who show signs of excessive use of tobacco or liquor. We cannot afford to place on our cars any man whose personal appearance may be repulsive to our passengers, nor can we afford to risk hiring a man who is a slave of the cigarette, or who needs the stimulus of alcohol to carry him through the ordeal of making application for employment.

"We further eliminate all applicants under twenty-one years of age or over forty years. The work on the street car is a man's job, and cannot be intrusted to a boy, nor can we hope to secure the best results from a man who has lost his spring of youth and is passing into the summer of middle age."

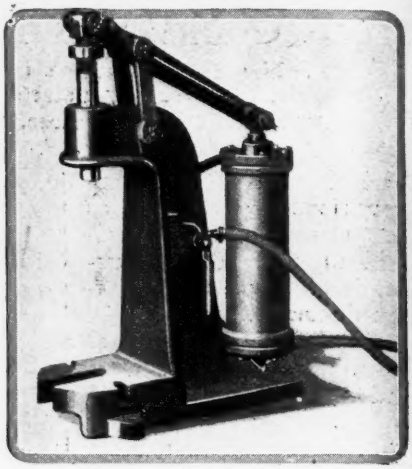
Many scientific appraisers of employees lay great stress on the applicant's walk. Much can be inferred from it, they say, as to habits of thought and conduct.

The Inventor Invades the Workshop and the Office

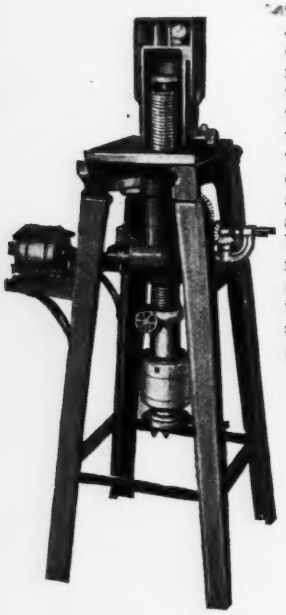


A dustless disk grinder with an adjustment for accurately grinding segment ends or any angular face

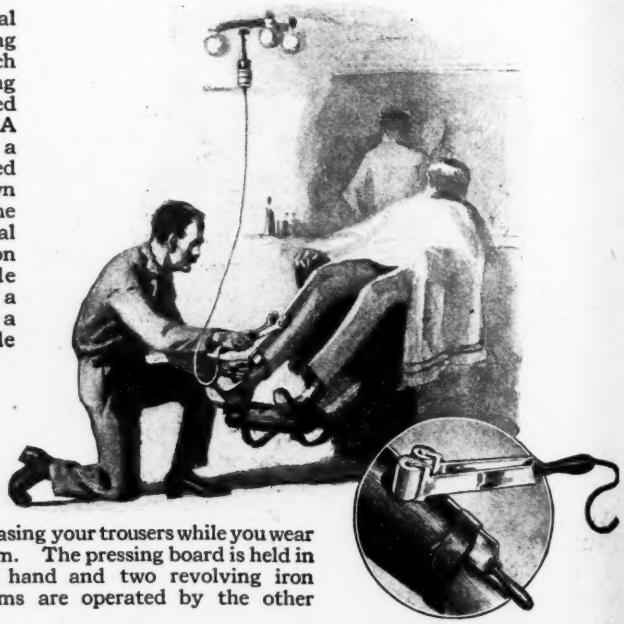
A file handle with an elastic ferrule. A spring holds the file tang in an elastic grip



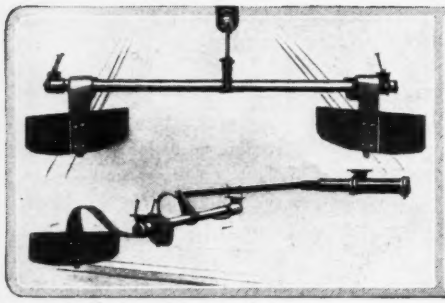
An air-operated arbor press; the downward or pressing stroke is slow, the upward stroke fast



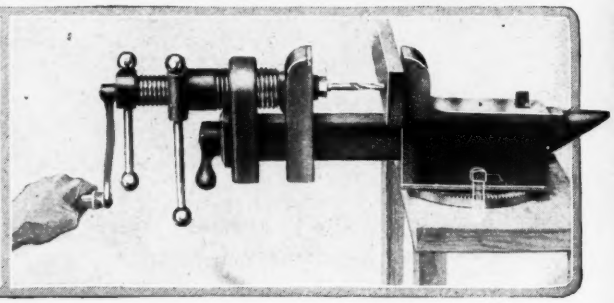
At left: An internal cylinder grinding machine in which the work-holding table can be tilted to any angle. A vertical bar with a circular rack is fed around and down at the same time by the horizontal motor operating on gearing. Inside the main bar is a sleeve containing a grinding spindle



Creasing your trousers while you wear them. The pressing board is held in one hand and two revolving iron drums are operated by the other



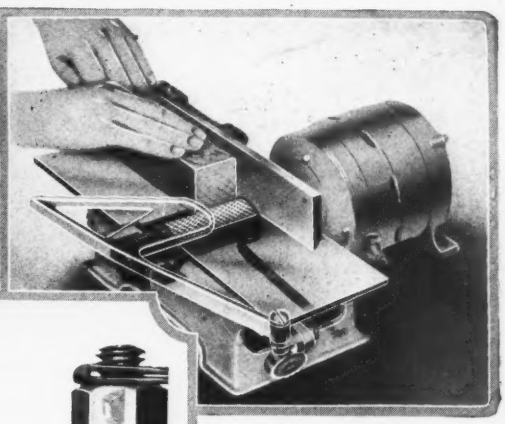
A street-car snow scraper with adjustable blades resting in rail flanges. It is operated by air or by a lever



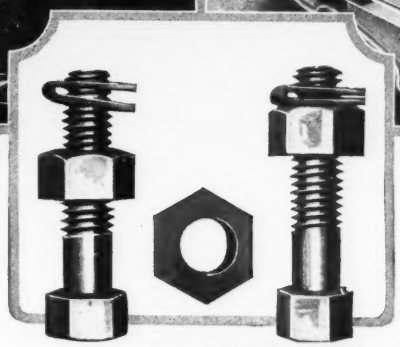
A drill press, vise, pipe vise and anvil all in one. A hollow screw holds a drill which may be revolved by handles. A steady wooden base is provided

And Here Is the Result in New Mechanical Kinks

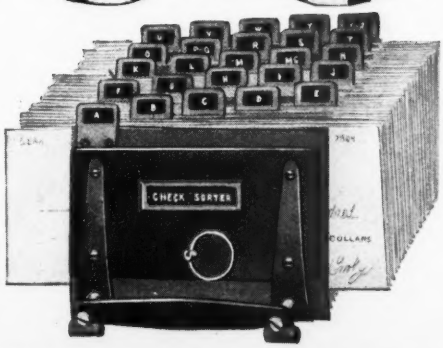
Above: Testing the strength of screwdrivers. The point is placed in a socket and turned with a wrench while the dial on the scale registers exactly the stress exerted



Above: A safety planer guard. A shutter surrounds the knife between cuts and an aluminum guard covers the unused part of the knife when the stock is being fed to it

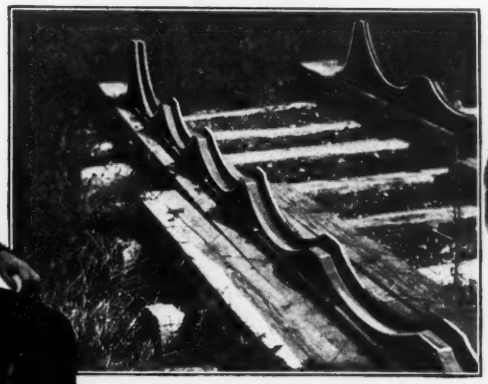


At right above: A spring lock-nut consists of a punching of spring steel bent double and tempered. The punching is so shaped that when finished the outline is that of a standard nut



At left: A convenient check-sorter with a capacity of fourteen hundred checks. When the checks are in place the front place is automatically locked so that there is no danger of losing the contents

Below: A barrel chair. The seat and back are made of two-inch slats. The arm rests are wide



Above: A new car bumper consists of a series of ascending flanged steps

Below: An automatic cut-out transformer for use with small currents, as for toys

A long pin jabbed into the cigar holds the appliance and serves as a shaft on which the disk slides

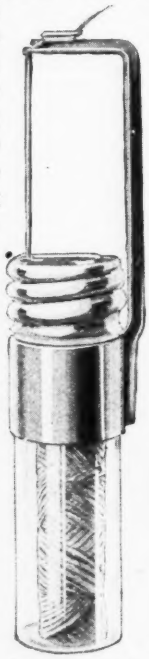
Ensnaring the Ashes of a Cigar as You Smoke

YOU need not let the ashes of a cigar get away from you. A new appliance has been devised for catching them and for holding them safely. You need only to turn a cigar which has this appliance until its butt-end faces upwards and then until its butt-end faces downwards and the cigar is decapitated of ashes, which are caught in a small receptacle.

The mystery is easily explained. A long pin, jabbed into the cigar, serves the double purpose of holding the appliance on and of providing a shaft on which the receptacle may slide. But this is not an ordinary receptacle. It is divided into two parts by a metal partition having a small opening. In the half nearer to the cigar is a spiral-shaped coil of wire while in the farther half is a metal disk placed near the opening in the partition. Into this disk the innocent ashes are made to fall.

A Convenient Holder for Dental Floss

YOU can clean your teeth after every meal very quickly and conveniently with the dental-floss holder illustrated. No bulky accessories have to be carried about, only a small glass tube an inch-and-three quarters long which can readily fit into a small pocket. The floss is contained in this tube and when wanted for use a short projection on it is slipped out to receive the end of the floss. The accumulations of food between the teeth can now be quickly and easily removed. The floss is tasteless. Dentists claim that such use of the floss is absolutely necessary for cleanliness.



The coil of dental floss in the jar is drawn out, one length at a time, and this length is held in position for use

A Stimulating Climate May Be the Cause of Suicide

IN estimating the relative stimulating power of the various climates of the world, Ellsworth Hungtington ("Civilization and Climate," Yale University Press) says that in England the mean temperature of the seasons and the degree of storminess are both highly favorable, while the seasonal changes are only moderate.

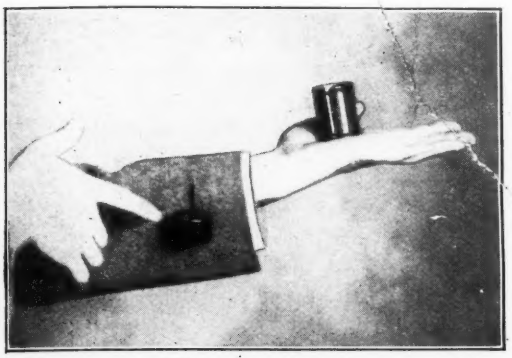
"On the other hand," writes Mr. Huntington, "Germany is above medium in temperature, and high in seasonal changes and storminess. In this respect, it resembles the northeastern United States and southern Canada. Japan is similar except that it is somewhat too warm and damp. The coast of British Columbia and the neighboring states is highly favorable in mean temperature, and medium in storminess and seasonal changes. Around San Francisco, the mean temperature is still better, but both seasonal changes and storms are mild. In compensation for this, however, there are frequent changes of temperature because fogs blow in from the ocean, and are quickly succeeded by the warm, bright weather which generally characterizes the interior. Farther south where the fogs cease, the conditions become less favorable from the point of view of the changes from one day to another, although the mean temperature of the seasons still remains advantageous.

"The chief defect of the climate of the California coast is that it is too uniformly stimulating. Perhaps the constant activity which it incites may be a factor in causing nervous disorders. When allowance is made for the fact that California's urban population is relatively smaller than that of states like Massachusetts and New York, insanity appears to be even more prevalent than in those states. Moreover, the cities of the California coast have the highest rate of suicide. In proportion to the population the number of suicides is greatest in San Francisco; then come San Diego and Sacramento; while Los Angeles and Oakland are exceeded only by Hoboken and St. Louis." Possibly these facts may be connected with the constant stimulation and the lack of relaxation.

FOR PRACTICAL WORKERS

Making a Coin Disappear at a Word of Command

HERE is a clever method of causing a coin to disappear. The apparatus required is very simple and easy to make, and the effect is satisfactorily perplexing.



The manner of disposing of the inner cup with the coin. Its hook catches on the coat sleeve

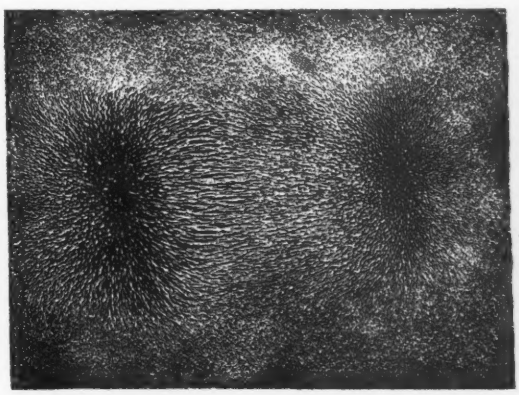
The performer extends his left hand which holds a small circular metal cup, or box, painted some bright color on the outside and jet black on the inside. Transferring the cup to his right hand he asks a spectator to drop a coin into the box while it is thus extended. The left arm and hand are now outstretched and shown empty, and with the right hand which still holds the cup, the left arm sleeve is pulled back and the metal cup containing the coin is placed in the palm of the left hand as in the illustration. At a command the coin vanishes and the box can be closely examined by the audience.

The trick is accomplished as follows: The cup contains a smaller cup which fits in it very easily and this smaller cup is lined and covered on the outside with cotton dyed a jet black to match the inside of the metal cup into which it fits. A small wire is attached to one side of it and extends upward, terminating in a hook. This smaller cup, which is only half as high as the one into which it fits, is slipped into the larger cup, the black wire hook which extends over the edge being kept covered with the thumb. When the coin is dropped into the box it falls into the inner cup. This is done while the box is held in the right hand. When pulling back the sleeves of the left arm this hook is allowed to catch into the cloth of the coat, which automatically pulls out the inner cup containing the coin. The covering of black cotton on this inner "fake" deadens all noise.

Any boy can do this stunt after five minutes' practice and will find it baffling, although it is one of the professional magician's most cherished little secrets. It is needless to say that the performer must stand slightly to one side so that no one can see the hidden "fake" when it catches on the coat sleeve.

Photographing Magnetic Field Lines Without a Negative

THE method described will produce perfect photographs, if the directions are followed carefully. In a dark room, lighted only with a ruby light, place a magnet beneath a non-magnetic surface. Place on this surface a piece of developing paper with the sensitized surface up, and on this sprinkle iron filings in a thin layer.

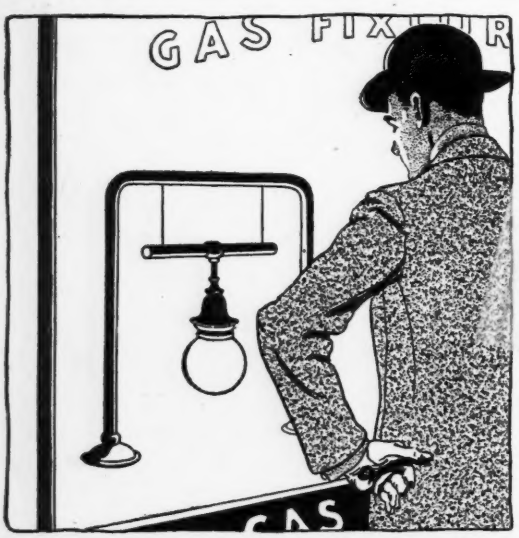


The lines of force taken on by the iron filings when placed over the magnetic field

A slight tap of the paper will cause the filings to take on the lines of the magnet force beneath the paper, as shown in the illustration. It is necessary that the printing paper be handled in a dark room and exposed to a light only after the filings have taken on the lines of force. After the paper is exposed to the light long enough it is developed in the usual manner. Blue prints may be made in the same way but the paper must be printed in the sunlight.—ALEXANDER V. BOLLERER.

A Gas-Lamp Riddle for a Store Window Display

A GAS-FIXTURE dealer in Brooklyn, N. Y., who was something of a window display expert as well, recently hit upon an

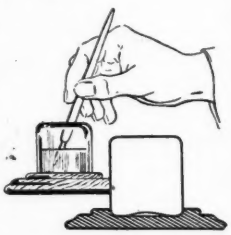


The lamp is suspended by wires and is without visible connection with the gaspipe line

ingenious scheme for attracting attention to his window. From an inverted U-shaped gaspipe he suspended by two fine wires a gas-lamp of the inverted incandescent-burner type. The wires were attached to a T-joint from which the lamp hung. The lamp burned brightly and attracted crowds just as he knew it would. Nobody could solve the riddle as to how the gas got into the lamp? The answer was this: Two tiny holes were bored in the upright posts of the U-bend. The holes were aimed exactly at the holes in the end of the gaspipe T-joint. Below the window, the U-joint was connected to the gas-main. When the gas was turned on, it shot from the two small holes straight into the ends of the T-joint and the lamp was lighted.

Cleaning Steel Pens with a Glycerine Sponge

THE illustration shows a European idea that is said to be a decided improvement on ordinary pen-wipers. It is a rubber sponge, wet with glycerine and placed in a glass holder. The sponge does not dry and is always ready. Glycerine takes up liquids readily, and it absorbs the ink from the pen by a mere contact or capillary attraction. A thin layer of glycerine adheres to the pen and preserves it, making it take the ink at once when dipped.



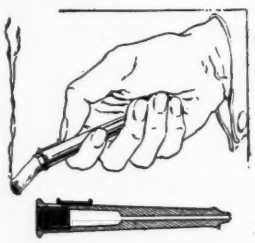
Glycerine-dampened sponge pen-wiper

Bending Brass and Copper Tubing Easily

THE following is an easy method of bending brass tubing so that it will not kink or split in the seams: Plug one end of each tube with a piece of soft wood. Place the tubes in an upright position and fill them with hot melted resin. The resin may be heated in a glue pot or a similar utensil. When cool the tubes can be bent to any desired shape. After bending, the resin is removed by holding the tube with the tongs or a rod and applying a blow torch, bunsen burner or other flame. The resin will run out and the tubing will retain its shape.—G. W. JAGER.

A Cigarette Holder Which Expels the Burned End

THE illustration shows a new cigarette holder fitted with a convenient device for expelling the burned end. This consists of a split ring which fits in the end of the holder as shown. On the outside is a projection joined to the ring so that by pushing on it the split ring can be slid partially out of the holder. The cigarette is inserted when the ring occupies the inside position. To throw out the burned end, slide the button forward. This opens the split ring and frees the end of the cigarette.



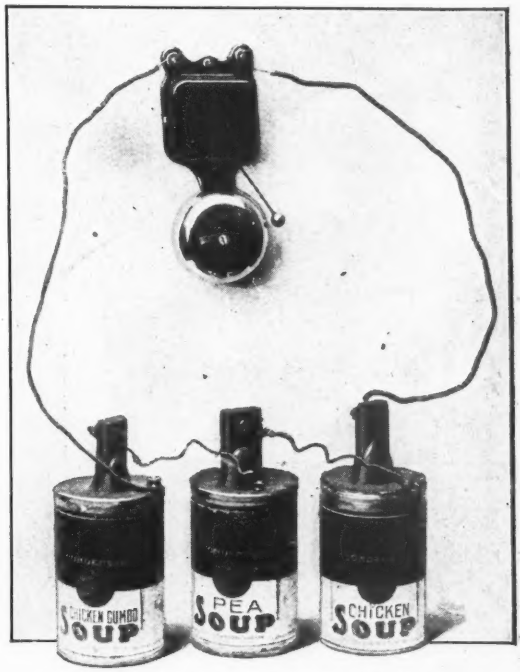
The split ring holds the cigarette end

Utilizing Tin Cans to Make Containers for Dry Batteries

THERE seems to be very little use for the emptied tin can—the kind in which soups and vegetables are sold. However, one inventor has proven their worth by using them as containers for dry batteries. The illustration shows three of these tins taking the place of zinc cylinders as the containing vessels and positive element of the cell. They were prepared in the following manner: The inner contents of four old exhausted dry cells, consisting of powdered carbon, peroxide of manganese and graphite, or black lead (plumbago) were taken and reduced to a powder by crushing with a mallet.

Four disks of white blotting paper were cut to fit the interior of the bottom and the same number of pieces were cut to lay in around the interior of the can, care being taken to have about ¾ in. project above the top so as to form a fold over the edge of the can. The blotting board was so folded at the bottom that it made a turned-in portion, and two more disks of blotting paper were then pressed into the interior to make a complete cell or well of paper all around the inside and bottom of the can. The dried material was then wet with a saturated solution of equal parts of chloride of zinc and sal ammoniac so as to convert the mixture into the same dry state. Each carbon-rod that had been removed from the old cells was heated at the bottom-end and for half its length in the flame of a gas-stove, and then allowed to cool. The cans were then filled nearly to the top with the chemical mixture which completely soaked the blotting-board lining. The second and third cans were treated similarly by pouring the contents of the first into the second and then into the third. The cans were then turned upside down for a short time until the lining became well soaked with the saline solution. Then they were ready for the filling. A couple of tablespoonfuls of the dampened carbon mixture was then placed in each can and a carbon-rod that had been dipped in the saline solution was pressed into the mixture. More of the carbon mixture was placed in around the rod and rammed down tight with a stout piece of wood driven with a wood mallet. The filling and ramming was continued until the can was filled to within ½ in. of the top. The wet blotting-paper lining was then carefully turned over the top of the carbon mixture and pressed down with the flat end of a clean stick, care being taken to keep the carbon mixture from flowing over and connecting the carbon-rod with the metallic part of the can, thus forming a short circuit and quickly exhausting the electrical energy generated. The cell was completed by covering the turned-over edge of the paper lining with a little dry sand or a mixture of dry sand and plaster of Paris. It was then filled to the brim with melted pitch. Common resin may be used for this purpose, but it is more expensive.

Each cell should test about 6 amperes.



Ordinary tin cans used for containers for the positive element of a dry cell battery

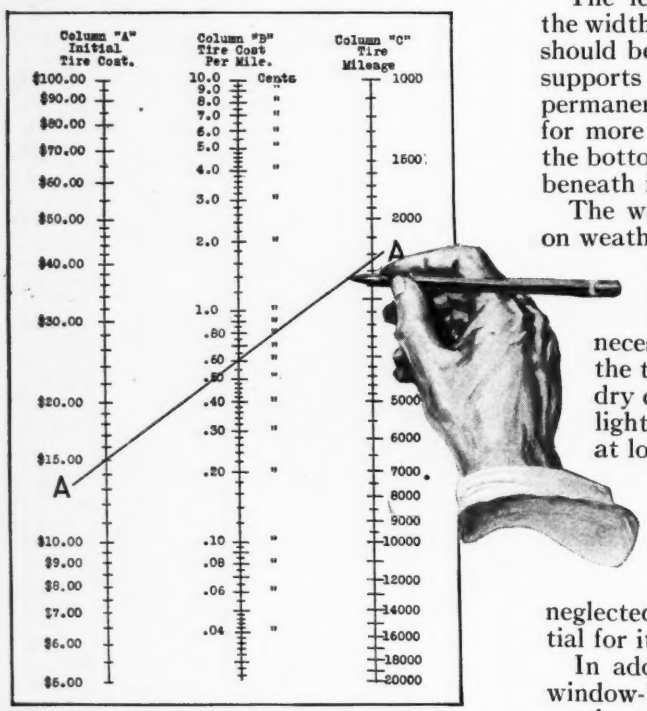
The three cans coupled in series gave about 2¼ volts, which rang a bell with considerable vigor. After several weeks of use these tin-can cells showed no decline in power. Connections are made just as to the ordinary dry cell.—ALFRED J. JARMAN.

An Oil-Gage for the Automobile Gas-Tank, Made from a Broomstick

TAKE a broom handle and saw off a 2-ft. length and saw a slot in one end to fit over the pet cock oil-gage. With this gage you can measure the gas and reach under the fender and see if the cylinder oil is right without getting the hat or coat soiled.

What Do Your Tires Cost You a Mile?

A CHART for calculating the cost per mile per tire of an automobile has been circulated by a manufacturer of



A chart by means of which you may quickly find the actual cost of a tire per mile

automobile tires. Given the cost of the tire and the number of miles it is used, a pencil and a ruler will determine the exact cost of a "tire mile" in an instant. Consulting the chart which is reproduced herewith, we will suppose, as an example, that a tire cost $15 and was used 2,500 miles before it wore out. The ruler is laid from the $15 mark to the 2,500 mile mark and the line A—A drawn. Where the pencil line intersects the central vertical line, the precise cost of the tire per mile is shown.

House Plants and How to Care for Them

THROUGHOUT the winter months flower lovers must depend on window-box gardens, unless they possess greenhouses. A satisfactory and attractive window-box may be made as follows: Take a box about 8 in. deep and cover the bottom of it with stones or broken pottery for drainage. On top of this place a layer of moss to prevent the soil from working down and clogging the openings between the stones. The stones and moss together should take up about 2 in. of the depth of the box. Fill in the remainder with soil to within 1½ in. of the top.

The length of such a box depends on the width of the window. Its upper surface should be level with the window-sill. The supports may be brackets, a table, or legs permanently fastened to the box. To allow for more complete drainage, bore holes in the bottom of the box and place a drip pan beneath it.

The watering of the plants will depend on weather conditions. On cloudy days in winter about once a week will be sufficient, while during the early spring months watering may be necessary every day. But even then the top of the soil should be allowed to dry occasionally. It is better to water lightly and frequently than heavily and at longer intervals.

The kinds of plants that will grow readily are begonias, ferns, geraniums, Kenilworth ivy, smilax and aspidistra. The latter plant will thrive even though neglected, and direct sunlight is not essential for it.

In addition to those mentioned for the window-box, palms, rubber plants and cacti may be grown in pots. The regular potting soil should be used, which consists of 1 part compost, 1 part good loam and 1 part sand. Although not essential, it is well to add 1/20 part of bone meal.

A potted plant must be examined from time to time to see if it needs a larger pot. This is done by inverting the plant when the soil is moist and tapping the pot until the soil and plant can be lifted out of the pot. If the ball of earth is entirely covered with roots it should be placed in a larger pot and new soil tamped firmly into the space around the ball.

To force the blossoming of geraniums indoors during the winter, the root growth should be restricted and the plants kept fairly dry. A potted fern must be kept moist all the time, but it must not be overwatered. Ferns should be given a bath occasionally by placing them in a tub and using weak suds made from a mild soap. All dust accumulation as well as minute insect parasites will thus be removed from the fronds. The suds should be rinsed off immediately. Palms should be watered regularly, but should not be kept moist.

A plant that is too large for the suds bath should be sprayed with clear water. Small quantities of bone meal and wood ashes must be stirred into the soil occasionally, or the plant may be watered with liquid manure or ammonia water—a teaspoonful of ammonia to 1 qt. of water.

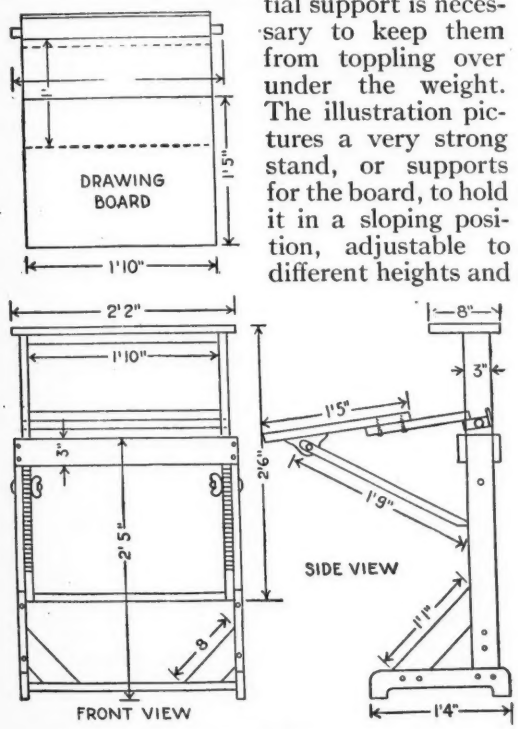
Rubber plants are given treatment similar to that of palms, but the soil should be kept more moist. Oleanders are treated in the same way. Aspidistras require less water than the palms and rubber plants. A dry sandy soil is required for the cacti.

Heating a Rusty Nail to Loosen It for Pulling

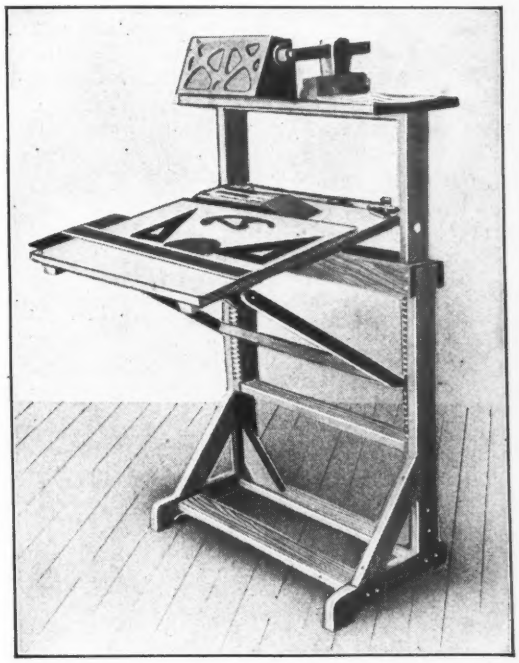
WHEN pulling a rusty spike from wood heat the nail head with a hot soldering iron, candle-flame or blow torch and it will come out easily. This method works equally well with rusty screws and screws that will not turn.

How to Make an Adjustable Drawing-Board Stand

DRAWING-BOARD stands are usually clumsy affairs, at best, for a substantial support is necessary to keep them from toppling over under the weight. The illustration pictures a very strong stand, or supports for the board, to hold it in a sloping position, adjustable to different heights and angles. The materials used in its construction may be of any straight-grained wood suitable in appearance and cost. Good pine or poplar is appropriate. The following is a list of materials required:



Details of the parts and manner of making the joints for the drawing-board stand



A substantial drawing-board stand which is adjustable to any angle and height

1 Drawing-board 17 by 22 in.
2 Standards 27 in. long, 3 in. wide and 1 in. thick.
2 Sliding standards 30 in. long, 3 in. wide and 1 in. thick.
2 Rails 26 in. long, 3 in. wide and 1 in. thick.
2 Rails 24 in long, 3 in. wide and 1 in. thick.
2 Rails 22 in. long, 3 in. wide and 1 in. thick.
1 Rail 24 in. long, 2 in. wide and 1 in. thick.
1 Top board 26 in. long, 8 in. wide and 1 in. thick.
2 Pieces for the feet, 16 in. long, 3 in. wide and 1 in. thick.
2 Braces 10 in. long, 3 in. wide and 1 in. thick.
2 Braces 14 in. long, 3 in. wide and 1 in. thick.
3 Pieces for adjustable supports 22 in. long and 1 in. square.
2 Brackets for underside of board 4 in. long and 2 in. wide.
1 Board 22 in. long, 12 in. wide and 1 in. thick.
2 Bolts ½ by 2½ in. with thumbnuts.

The drawing shows the manner of construction. The main standards or supports are joined together by four cross-pieces or rails fastened in place with dowels or long wood screws. If screws are used procure round-headed ones. The braces are fitted in on the proper angles and fastened with screws. The two upper and longest cross-pieces are fastened to the edges of the standards to make a space between for the sliding standards.

The sliding standards are joined at the

upper and lower ends with a cross-piece, and a slot is cut in the lower part for the bolts. One edge of the lower part on each standard is notched or cut like teeth on a rip-saw. These are for holding the lower ends of the adjusting pieces for the drawing-board. A ½-in. hole is bored in the upper part of each lower standard 6 in. from the top for the bolts. The top is finished with a board to make a lamp-shelf or a place for data sheets.

The rail 24 in. long is cut to make a round pin on the end about ¾ in. in diameter, and a ¾-in. hole is bored in each upper support 10 in. from the top to receive the pin. On this rail a board is fastened so that a small box may be made on the rail above it to hold pencils, penholders and ink. One edge of the drawing-board is fastened to the lower edge of the board to make the whole into one built-up piece, forming a notch above the drawing-board to hold the drawing outfit and rules.

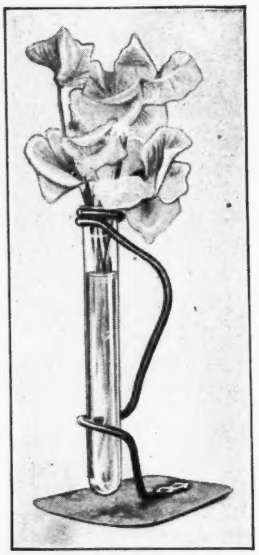
The finish may be as elaborate as desired; but for this stand a good stain was applied, after smoothing all surfaces with fine sandpaper. Then a good coat of wax was given instead of varnish.—N. J. PARKER.

Enlarging Wooden Pulleys by Building Up the Face

WHERE wooden pulleys are used on the main shaft and more speed is desired of one or more machines, it is not necessary to purchase larger pulleys. If a 10 in. pulley is in use and one 12 in. is wanted, simply nail cleats, 1 in. square and as long as the pulley is wide, completely around the pulley face. Then lengthen the belt accordingly and start the machines. The increase in speed will more than pay for the trouble.—EDWIN R. MASON.

Vasettes Made of Copper Plate, Wire and Test-Tube

THE vasette shown can be easily made by any one who has a ball peen-hammer, a small hand-drill and a vise. The base is cut from No. 16 or 18-gage copper in any shape, such as a clover leaf, heart, circle or trapezoid. The base shown here happens to be a trapezoid design, the long side being 4 in., one short side 2 in. and the other side 3 in. It is shaped with the ball-end of the hammer to give the customary beaten effect. The center may be raised or not as desired. After it is hammered it should be gone over with a file and emery-cloth and all sharp edges and corners removed to prevent its scratching the furniture. The container is a test-tube 6 in. long and ¾ in. in diameter, which can be purchased at any local drugstore.

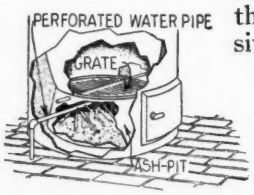


Test-tube mounted in copper wire stand

The standard is of 3/16 in. copper or brass wire 12 in. long, hammered to match the base. One end is flattened and two 1/16-in. holes drilled in it about ¾ in. apart. The standard is then bent in the desired shape around an iron rod or pipe the diameter of the tube, after which it is placed on the base and centered. Two corresponding holes are drilled in the base, and then it is riveted. The test-tube is put in place and the wire straightened up at right angles to the base. Care should be used not to crush the tube during this operation.—FRANCIS W. NUNENMACHER.

Avoiding the Dust from Ashes in an Old Furnace

TO prevent the discomfort arising from the flying dust of coal ashes when handling a hot-air furnace in a house, the introduction into the ash pit of a perforated pipe connected with some convenient source of water supply, and controlled by a valve outside the furnace casing, is a great convenience, and neither difficult nor expensive to instal.



Dampening the ashes to prevent the dust

The pipe should be of black wrought iron and the perforations should not be over 1/16 in. in diameter. For the ordinary ash pit ½ in. pipe, perforated about 2 in. apart in such a way as to spray the greatest amount of floor space, will be satisfactory. The accumulated ashes should be sprayed once or twice a day, or when attending the fire. The connection can be made by the local plumber.—EMMA G. WALLACE.

Winter Camps

by A. M. Parker

ALTHOUGH appealing to red-blooded lovers of the outdoor life, and offering an outing which affords deep enjoyment to the vigorous, winter camping is not very generally indulged in. But a long snow-shoe tramp across country or a "hike" into the wilds at this season will give an experience delightful to the jaded seeker after novel outings. Due preparation should, of course, be made, bearing in mind the conditions.

Outfits may be divided broadly into two classes—a pack sack and a sled or toboggan. The pack sack outfit is to be carried in districts where it is impracticable to use any conveyance; hence it must be light, and yet include the essentials of shelter, food, bed and tools.

The problem of shelter is solved if log cabins are located at the proper points along the route, but as this is unlikely it will not be considered. The fact that a tent cannot be satisfactorily heated by a camp-fire in front, but demands a stove, puts it out of the pack sack class, so only open front camps will be considered. Several types of these shelters are on the market, of which the Baker tent, Miller's "Forester" and the simple "Fly" may be mentioned as examples.

With its awning and its head room the Baker is more comfortable, but heavier than the other styles. It is available in a wide range of sizes. The Forester is ideal for two men, being light and quickly and easily erected, requiring but a tripod of poles; but it is rather cramped for head room in a storm-bound camp. Properly pitched, it is, however, the best storm shelter of the three. The "Fly," which is simply a tarpaulin fastened on a slant frame of poles, is the simplest of all, but requires more work in pitching. Should you ever be benighted in winter woods with but a single pair of blankets, use one to make a fly shelter like the one shown on the following page. The important feature of all these open-front tents is that the slant of the roof deflects the heat of the fire to all parts of its floor. Three pairs of good wool blankets, or their equivalent in quilts, is about the minimum for comfort. Rolled up in the tarpaulin or tent the blanket pack is easy to carry.

The axe is carried in the belt or thrust in the end of the blanket pack. It should be about 2 lb. in weight with a 20 to 24-in. handle. Make sure of the reliability of the handle. Fold several plies of tough paper (any paper will do in a pinch) over the edge of the axe and tie it with a string. No matter how sharp it is the axe will not cut through this muzzle.

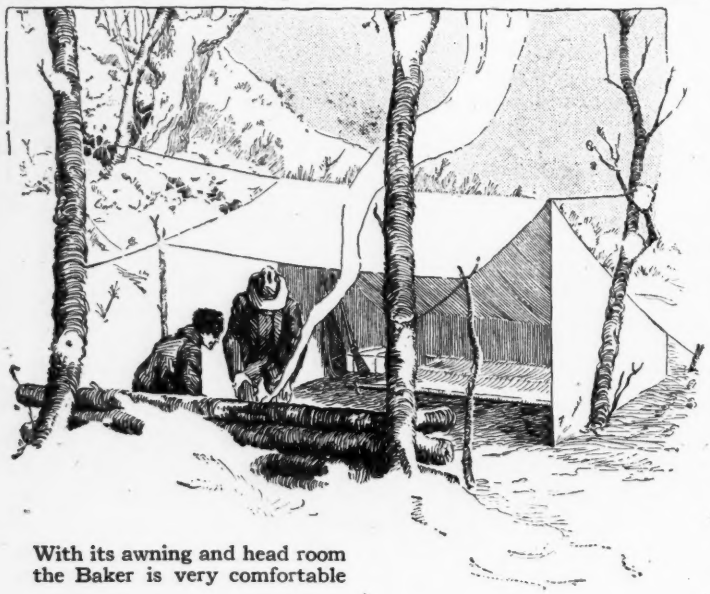
The usual light cooking outfit consists of 1 mixing pan, inside of which nests: 1 two-quart tin stew pail, 1 tin tea pail, slightly smaller; 2 tin or granite cups; 2 tin or granite plates; 2 large spoons; 1 long-handled pressed steel fry pan.

These can all be carried in a small cotton sack. For all culinary operations use a hunting knife. Leave table knives at home, and use a pointed stick for a fork. An aluminum baking reflector with an 8 by 12 in. pan, is a convenience that will add much to the variety of the fare. With its board the weight is 3 to 4 lb., but it is possible to do the baking in the fry pan.

Sled or Toboggan Outfit

Deep snow makes otherwise impassable country an open road to one wearing snow-shoes. Load the outfit on a toboggan. With the improved weight-carrying capacity

afforded by the toboggan the light outfit may be augmented, and the comfort consequently increased, by the addition of



With its awning and head room the Baker is very comfortable

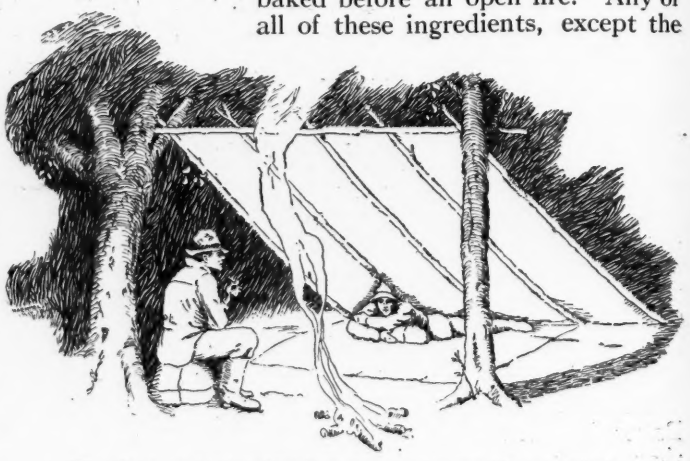
1 robe about 6 by 6 ft.; 1 tarpaulin; wall tent, 7 by 7 ft. to 8 by 10 ft.; 1 cross-cut saw, 4½ or 5 ft.; 1 axe 3½ or 4 lb., full handle; collapsible box stove about 12 by 12 by 24 in., with pipes, and bottom-hinged end door.

Sleeping bags are good if made right, but with tarpaulin on the brush of the bed, one pair of blankets underneath and two pair over, with the robe covering all, you have a combination equal to most bags, without their high cost.

See that the tent is fitted with a stovepipe ring just inside the door. Remember that most tenting materials are very inflammable. The so-called balloon silk burns without smoke, smell or flame. The silk fabrics and mixtures are ideal for lightness and imperviousness to moisture. A box style camp stove is better than one fitted with an oven in that the former is all firebox. Have the door nearly the full size of the end and hinged at the bottom. On this door, propped up at the correct angle, a fry pan of dough may be baked.

In supplying the demand of a winter camp for a bountiful supply of wood the cross-cut saw is a great labor saver. Protect the teeth with the grooved strip which came with the saw from the hardware store, and lay it flat on the bottom of the toboggan. The handles may be pushed into the end of the blanket pack. The provision list for a winter trip will be practically the same as for summer, with perhaps an increase in the heat producing fats and sweets—bacon and sugar. It is impossible, of course, to carry any canned fruits or vegetables. Modern dehydrators have made available a great variety of vegetable food, and there is a milk powder which makes a passable parody on the natural article.

Should the trip be but a short one, hunger may be satisfied with sandwiches and other substitutes for real food, and the treat of camp bread, called in the Canadian West "Bannock" will be missed. It consists of flour, baking powder, a little salt, sugar and shortening mixed with water to as thin a dough as can be kneaded with the hands into a ½ or ¾-in. disk, the size of the pan. It is then baked before an open fire. Any or all of these ingredients, except the flour and water, may be omitted and the resultant Bannock still be very palatable. Be sure to have sufficient food for the trip, but not an over supply to make the load too heavy to carry comfortably.



The fly tent is simplest but requires more time to pitch. It is a tarpaulin fastened to a slanting frame of poles

Personal Equipment

Woolen underwear, toque, mittens and socks, a heavy shirt, waistcoat and sweater, with a sheep-lined or mackinaw coat for extra cold snaps, are very necessary. A pair of tweed trousers under khaki overalls will keep out any storm. True, the cotton overalls wet up easily in snow, but they dry quickly when hung up in camp. A slipper made of harness-felt sole and cloth vamp, with two pairs of socks, will be ample protection for the feet. Excepting in wet snow, chrome tanned horsehide moccasins are the best winter outer footwear. I have had much comfort in all weathers out of a pair of leather topped rubbers, but the only foot covering that can be used satisfactorily on snowshoes is moccasins. Ordinary rubber shoes are excellent to wear around camp in the evening.

In most localities winter is in the closed season for game, but if the possession of a rifle will add to the enjoyment, take it along. Carry it in a loose mouthed cloth or canvas case. On preparing to shoot, take off your mitten, run the hand up inside the case, grip the rifle and slip off the case, allowing it to hang over the left arm. Treated in this way the muzzle, sights and hammer are always clear of snow. Do not bring the rifle into the heat of the camp fire unless to clean it. Water condenses in the bore and action, inducing rust spots.

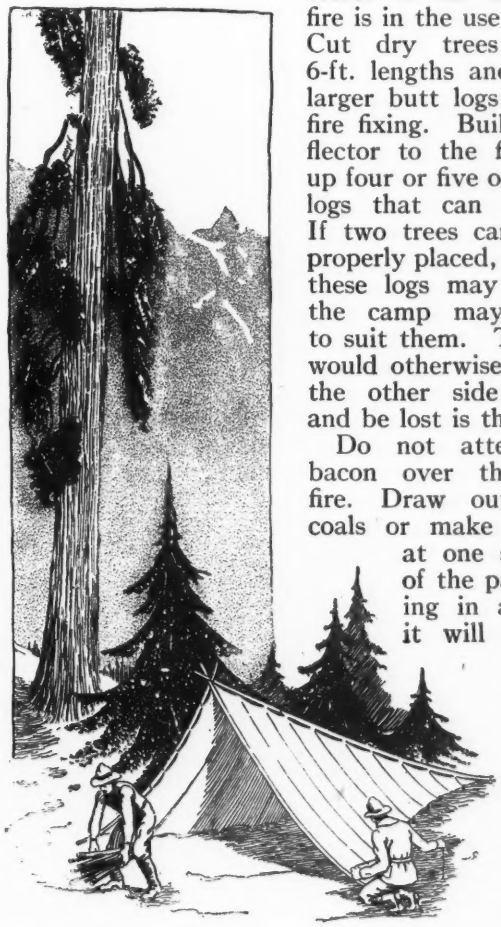
Articles such as matches (some in waistcoat pocket and some in the safe), compass, sewing outfit, coil of snare wire for repairs and small whetstone need but passing mention.

The deceptive weakness of winter sunlight, the slowness of the emulsion in intense cold, and the danger of electric markings on a hastily wound film are points to be remembered in taking photographs. Keep the kodak away from the warmth of the fire.

Making Camp

Choose a level, clear spot in a thick clump of trees, in close proximity to some dry, firewood trees. Dig out the snow, if deep, with the snowshoe. Pitch camp facing at right angles to the wind. If it is stormy, bank with old logs, brush or snow, or all three. If faced directly away from the wind, the eddy formed by the tent will suck the smoke back into the camp.

Cut and thaw out enough evergreen bough tips to make the bed and also to carpet the rest of the camp floor. The secret of an all-night open fire is in the use of large logs. Cut dry trees into about 6-ft. lengths and reserve the larger butt logs for bed-time fire fixing. Build a back reflector to the fire by piling up four or five of the greenest logs that can be procured. If two trees can be located, properly placed, against which these logs may be propped, the camp may be set up to suit them. The heat that would otherwise radiate from the other side of the fire and be lost is thus conserved.



This tent is ideal for two men, being light and easily erected with a pole tripod

Do not attempt to fry bacon over the big camp fire. Draw out a bed of coals or make a small fire at one side, the size of the pan. If camping in a closed tent it will be necessary to use a collapsible stove. To keep a fire all night, put in two halves of the largest blocks it will hold and choke the draft hole with ashes. Further checking of the draft may be effected by partially opening the top lid nearest the stove pipe.

Dig down nearly to the ground when getting snow for melting into water. There it is nearly all ice crystals, and contains much more water than the new, fluffy, top snow. See that none of it sticks out over the side of the pail in melting, for its ability to acquire a smoky taste is remarkable.

A rolled up coat or dunnage bag is a good substitute for a pillow and when these are not available put a block of wood under the brush at the head.

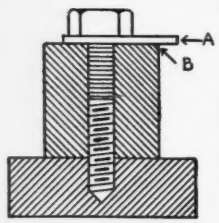
The extent of the provision supply will be governed by the proposed duration of the trip, but do not figure too closely. Better come out with a surplus than be hungry.

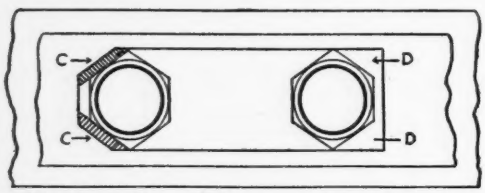
Removing Automobile Engine-Valves Enclosed in a Sleeve

AN automobile engine-valve set in a sleeve is rather difficult to remove at times owing to the fact that both sleeve and valve must be removed at the same time and the former is apt to bind in its casing. A simple method is to remove the lever-arm that depresses the valve-stem and slowly turn over the motor-shaft. The air compressing under the valve will drive it from the cylinder-head.

A Bolt Washer Used for a Nut Lock

TO prevent bolts or nuts from becoming loose through vibration, a special metal washer, as shown in the sketch, may be inserted between the head of the bolt and the surface of the wood or metal. The washer *A* may be made of sheet iron or brass about 1/32 of an inch thick. After the bolt has been tightened so as to grip the washer firmly, the edge of the washer is made to turn over the edge at *B*, while the other projecting end is bent up around the nut or head of the bolt. In this way the washer grips the nut and prevents it from loosening. The corners of the washer are shown bent in their holding position at *C* and before bending at *D*. Such a washer is only applicable to bolts and cap screws where they are used in pairs and close together.

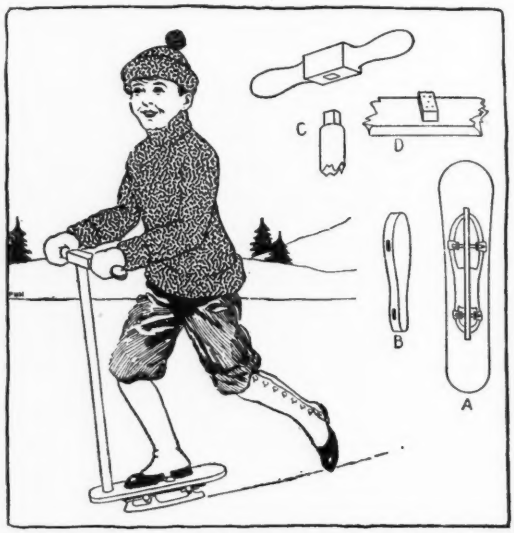




Metal washers with corners turned up to make the nut vibration-proof when it is set

Making a Kick-Mobile for Snow and Ice

THE illustration shows how the kick-mobile may be used for winter sport by substituting a skate-runner for the wheels. If it is difficult to remove the wheels from the kick-mobile the entire skate-mobile can be made as follows: The main part or foot-rest consists of a board 18 in. long, 4 in. wide and 1 in. thick. The bottom view of this is shown at *A*. The shape of the board represents a large shoe-sole, on which a block *B*, also the shape and size of the shoe-sole, is fastened. This is used for a base on which to clamp the skate, just as you would fasten it to a shoe. The steering-post is a broom-stick with its ends squared off, or tenons made to fit into mortises. The mortises for the handle are cut into the crossbar in its center and in the front end of the base *A*. These should be made a close or drive fit to make them solid.



A skate-runner makes an excellent substitute for the wheels on a skate-mobile for winter sport

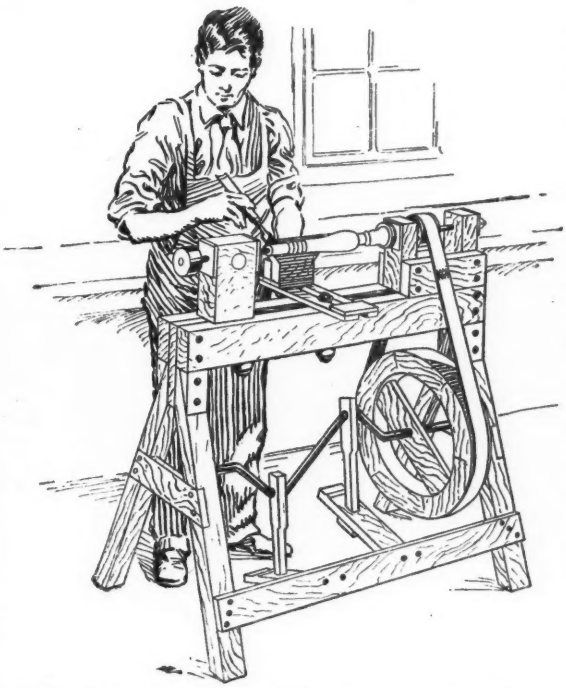
The details of the upper end of the post and handlebar are shown at *C*. Glue and brads fasten this joint in place. A little to the rear of the central part of the platform, a block *D* ½ in. thick is screwed on and used as a buffer or stop for the heel of the shoe. It is best to use hardwood for all parts and to paint or oil the surfaces when the machine is complete. The skate may be removed for sharpening at any time. On snow roads it is not necessary for the skate to be sharp, for a dull skate will run satisfactorily.

A Craftsman's Combination Foot-Lathe

An inexpensive combination scroll-saw and wood-lathe

By C. H. Patterson

SIMPLICITY and economy have been kept in view in designing this combination lathe. It will swing 6 in. above the bed and 4 ½ in. above the tool-rest support, and it is about 18 in. between centers. The swing can be made greater by increasing the height of the head and tail stock-standards, and the length of the bed can be increased to 4 ft., if a third bend is made in the crank as shown in the center line drawing. In this case, it will be necessary to use a crank of larger diameter, say, 1¼ in. The bed of the lathe is made of two hardwood timbers 36 in. long, 4 in. wide and 2 in. thick, separated, as shown in the end elevation, by 1 by 3-in. pieces, to which they are bolted. The left piece forms a part of the outer standard, as shown in the detail drawing of that standard. The legs are of stock 3 in. wide and 2 in. thick. A triangular piece is sawed from an upper corner of each leg. These pieces are nailed to the outer surface of the legs, care being taken to place them so that they will not be in the way of the holes bored for the bolts. These holes are then bored and the legs bolted to the 1 by 3-in pieces mentioned. It will be seen that the triangular blocks provide parallel surfaces for the heads and nuts of the bolts that pass through the legs.



The lathe as it is used for turning wood. Attachments may be applied for other kinds of work

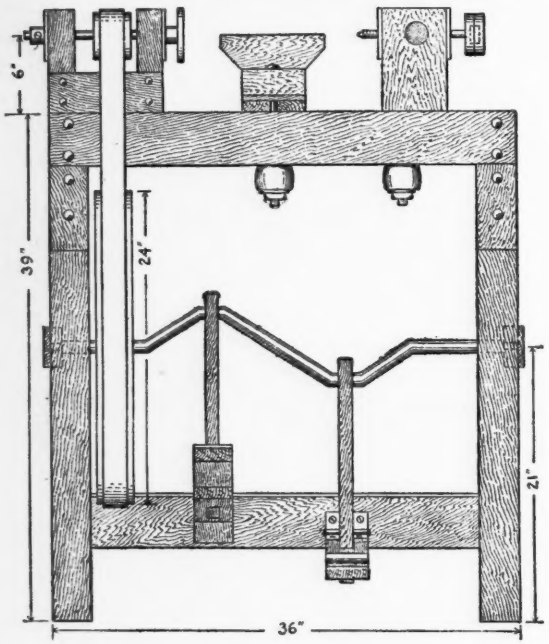
The crank is of 1-in. iron, bent as indicated in the center drawing. This will be a job for the blacksmith and machinist, but the cost of the completed crank should be small. For a distance of 1 in. inward from the ends of the crank, it is turned to a diameter of ¾ in., to provide bearing surfaces. Pieces of ½ by 3-in. stock are screwed across the outer sides of the legs. To the inner surface of these pieces are nailed other pieces of 1-in. stock, in which holes should be bored to receive the bearing-ends of the crank.

A strip of 1 by 4-in. material is nailed across the back of the legs and to it are screwed the hinges upon which the pedals swing. The pitmen may be cut from a 1-in. board. Holes are bored in them to receive the cranks. A central slot is made with a saw-cut in the ends of the pitmen for about half their length, and the parts are pried open and slipped on the cranks. Some pieces, 1 by 3 by 4 in. are nailed to the lower side of the pedals and nails are passed through them and through the pitmen. Half round strips are nailed across the pedals near their free ends for the feet to rest upon.

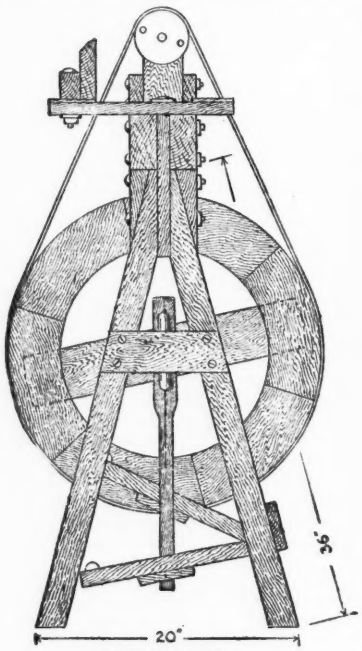
The drive wheel is built up of three series of segments cut from 1-in. board, preferably of hardwood. The single spoke in this wheel is also built up of three pieces. The central piece of the three must extend well into the wheel-segments. These segments can be sawed with a band-saw. The hole in the spoke that receives the crank-shaft should be bored true in a boring machine. A smaller hole is bored through the spoke to receive a pin, for pinning the wheel to the shaft. After the wheel is mounted, a board may be clamped across the legs, close to the wheel, for a

rest in using a turning gauge, for truing the wheel.

The outer standard of the head stock is made of stock 3 in. square, and the inner standard of 2 by 3-in. wood. Holes 1¼ in. in diameter are bored through these standards at the proper height for mounting the spindle, which may be of ⅜-in. shafting and about 12 in. long. Holes ½ in. in diameter are bored vertically from the top of the standards to meet the 1¼-in. horizontal holes. These holes receive the babbit metal which forms the bearings for the spindle. Four pieces about 3 in. square



FRONT ELEVATION OF LATHE



END ELEVATION
TAIL STOCK REMOVED

Side and end elevation views of the lathe without its attachments, giving general dimensions for the larger pieces in its construction and showing the location of the parts

are cut from a rather thin board, and ⅝-in. holes are bored through their centers.

It is best to bore the holes before cutting out the blocks. These blocks are clamped or lightly nailed to the faces of the standards so as to support the spindle in its true central position and in line with the bed of the lathe. The parts of the spindle that lie within the standards should be wrapped with a single thickness of paper, which may be pasted to the spindle. Putty should be used to close all cracks so that the melted babbit-metal cannot escape. Old type metal may be melted in an old baking powder tin can, over an ordinary gas or gasoline burner, and used for this babbit-metal. The can must be without soldered seams or joints. A sharp V-shaped lip should be formed in the rim of the can for pouring the metal. A handle for the can may be quickly made by twisting a wire around it. It is well to heat the spindle before pouring the metal, otherwise the metal may be chilled and the casting spoiled.

The spindle may be heated by tilting the lathe sidewise and placing a small oil-stove or a large lamp below it. Having heated the spindle, place the lathe in an upright position and pour the melted babbit-metal in the vertical holes, filling them well to their tops. When the metal has set, remove the retaining blocks and remove the spindle from the bearings and then take off the bits of wrapping paper. Drill ⅛-in. holes down through the vertical extensions of babbit-metal to form oil-holes. The standards may be strengthened by bolting pieces of 1 by 3-in. material across their sides, above the bed.

If the craftsman has access to a foundry, a pattern may be made and a casting obtained for the face-plate which may be drilled to fit the spindle, to which it is secured by a pin. Another method of attaching the face-plate is to cut a screw

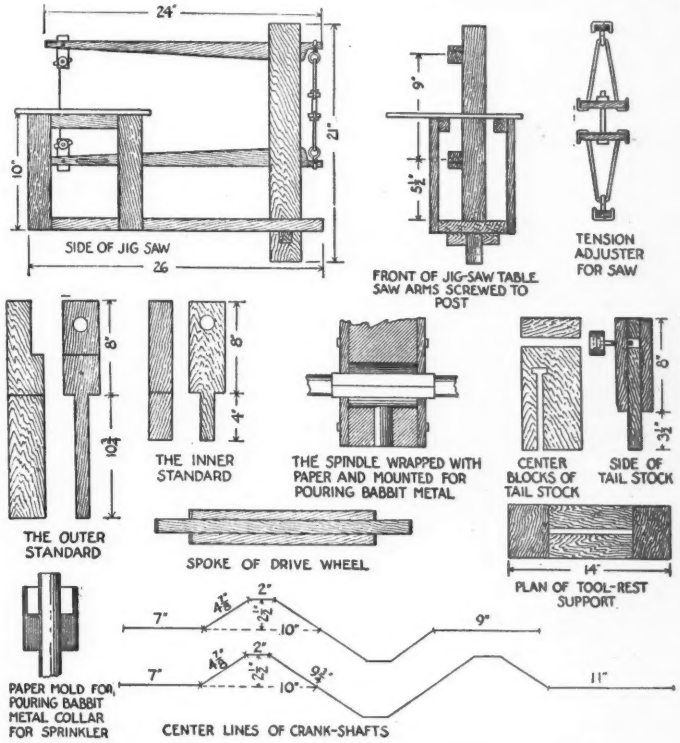
thread on the spindle and to drill and thread a corresponding hole in the face plate.

Another method of making a face-plate is to thread the spindle to receive a large nut, to which a metal disk about ¼ in. thick and 4 in. in diameter has been fastened with small machine-screws. It is well to have the surface of the face-plate turned true in a machine-lathe. Holes for 1 by 3/16-in. stove or machine bolts are drilled and threaded in the face-plate. A babbit metal collar for the outer end of the spindle may be cast by building up a paper mold around the spindle as indicated in the drawing. The spindle should first be wrapped with a single thickness of paper as for casting the bearings.

Another way to make a collar is to thread the end of the spindle to receive a large nut. The rounded face of the nut should be placed next to the standard and the thread cut the proper distance down the spindle so that the nut shall bind upon the end of the thread, before it binds upon the standard. Metal plates 3 in. long, 2 in. wide and ⅛ in. thick are screwed to the outer faces of the standards to receive the end-thrust of the spindle. The pulley is about 3¾ in. in diameter and is secured to the spindle by a pin. The faces of the pulley and drive-wheel should be turned slightly convex. The support for the tool-rest is made of two wood pieces each 14 in. long, 2 in. wide and 1 in. thick, fastened together by means of cross strips, leaving a ½ in. slot between the pieces to receive the center bolt. Hand wheels 2 in. thick and 3 in. in diameter are used for tightening the nuts on the bolts of the tool-rest and tail-stock. The wheels may be turned from wood.

The tail-stock is built up of three blocks cut from 1-in. board. A slot to receive the square head-locking bolt is cut in the center block. The center block may be bored to receive the tail-spindle or it may be made of two sections as shown. The tail-spindle is a ⅜-in. square head-bolt about 10 in. long. The hand wheel for the tail-spindle is made of two ¾ by 3-in. wood wheels nailed together. One of these is bored to receive the bolt, and square recesses are cut into the inner faces of the wheels to receive the head of the bolt. Screwed to the tail-stock are two iron pieces, each 3 in. long, 1 in. wide and ¼ in. thick. One of these is drilled and threaded to receive the threaded end of the bolt, and the other piece is drilled the full diameter of the bolt. A hand-wheel, bolt and nut are used for locking the tail-spindle. The head of this bolt is recessed into the hand-wheel in the manner described for the spindle-bolt. It may be necessary to cut the thread of the tail-bolt somewhat longer than the thread found upon it. The end of the bolt is filed to a conical point.

A spur center is made by screwing a 3 or 4-in. wood wheel to the face-plate, passing the screws through the wood into the holes in the face-plate. The heads of the screws must be countersunk into the wood. Reverse the position of the tool-rest, turn the lathe and mark the exact center of the wheel. Drive a nail for a center spur, file it and break off surplus



Details of the parts for making the jig-saw and tool-rest attachment and curves for crank-shaft of two lathes

length and sharpen the spur. Drive two smaller nails for drive-spurs and sharpen them in like manner. The distance from the center of the driving-spurs may be varied to suit the work in hand. A screw-center may be made by passing a wood screw outward from the center of another wooden face-plate wheel. A simple strip of wood may be used in place of the wheels.

Drilling may be done in the lathe by using square shank, bit-stock twist drills. Screw a wood wheel to the face-plate, find its center and cut a square tapering hole to receive the shank of the drill. Remove the tool-rest and in its place set a small but strongly made box about 10 in. high and 5 in. wide. On the lower side of the box, nail a strip of wood 1 in. square. This strip slides in the channel in the lathe-bed and keeps the box from turning around. Move the tail-stock up to position and use the tail-screw for advancing the work against the drill. The material to be drilled rests against the left side of the box, and the screw bears against the right side. If round material is to be drilled, gouge out a semicircular channel in a wooden block, place it against the side of the box, and let the material lie in the channel.

The jig-saw is supported by a baseboard 26 in. long, 6 in. wide and 1 in. thick, which is bolted to the bed by using the bolt from the tool-rest. The baseboard is slotted to receive the bolt. The standard which supports the saw-arms is fastened to the baseboard by a tenon and wedge, as shown. The standard may be of 2 by 3-in. stock. Added strength may be given to the standard by attaching a common shelf-bracket. Cross strips are nailed to the saw-table and to these strips and the baseboard are nailed four supporting strips. The ends of the saw-arms are slotted to receive two pieces of flat iron each 2½ in. long, ¾ in. wide and 18 in. thick. These are drilled to receive the pins which pass through the arms, and the wing-bolts used for clamping the saw. The construction of the tightener for the saw is plainly indicated in the drawing.

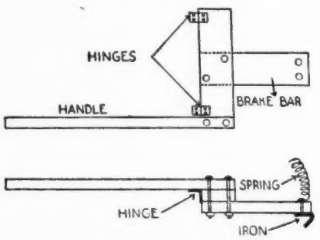
The saw is driven by means of a ¼ by 3-in. bolt inserted about 1¼ in. from the center of a hardwood face-plate wheel, attached in place of the spur center. The head of the bolt should be countersunk into the wood and should be placed next to the face-plate, so that the bolt cannot by any chance come out while the saw is in use.

A Hand-Brake for a Flexible Runner Sled

A VERY efficient brake for the modern flexible steel sleds may be constructed of the following materials:

2 small hinges and screws
4 bolts ¼-in. in diameter and 2½ in. long
2 bolts ¼-in. in diameter and 1½ in. long
1 coil spring
1 piece of tire-iron 3 in. wide and 6 in. long
1 piece hardwood 24 in. long by 1 in. square
1 piece of hardwood 12 in. long, 3 in. wide and 1 in. thick
1 piece hardwood 2 in. longer than width of sled and 3 in. wide by 1 in. thick

The long piece of wood should be rounded off on one end for a handle, then the three



The parts of the brake and how they are attached to the sled

pieces of wood are bolted together and the hinges screwed on as shown. After this part is complete the tire-iron is bent into an L-shape and two ¼-in. holes drilled in one surface and bolted to the end of the 12-in. piece. The brake is then ready to be put on the sled, by screwing the hinges to the long narrow pieces of the sled which run parallel with the runners. The spring is fastened between the 12-in. piece and the under side of the sled in such a way that it prevents the brake from dragging. A pull on the handle will force the iron into the snow and stop the sled. The spring holds the handle of the brake level with the top of the sled and is out of the way until needed to stop the sled.—Wm. A. Leech, Jr.

Interesting Winter Games

By Stillman Taylor

The Snow Dart

THIS is a favorite game with the Cree Indian boys of Canada, and even the dignified warriors like to try their luck at the dart. It is a game for the snow, and may be played by two or more persons.

The snow dart is a piece of broomstick and the snow snake is cut from a tree branch

The dart is 8 or 10 in. long, whittled from a piece of wood about ¾ in. in diameter—a piece of broomstick will prove just the thing. Shape the dart as shown in the drawing—the larger end bluntly pointed and the body tapering down to ¼ in. at the other end. Finish it smooth with a scraper or sandpaper.

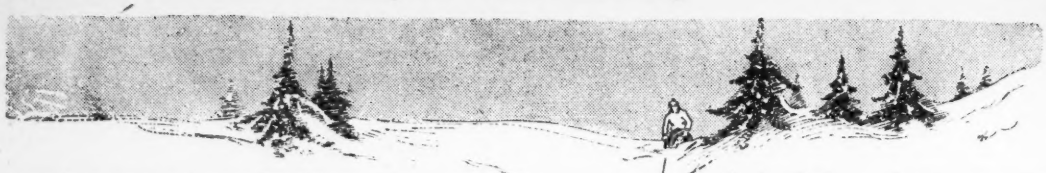
For playing, a narrow groove or track about 60 ft. in length is marked out on the side of a hill or other slope. The track is then watered and allowed to freeze to make a smooth slide. At intervals along the slide make small barriers or bumpers, four being the usual number. The rule of the game forbids shoving the dart, and so it is merely placed in the groove at the top to travel downward under its own momentum. Of course the object is to slide the dart over all the four bumpers. If this is done four consecutive times by a person he wins the game, no matter how the score stands in points. The players may choose partners instead of playing individually, thus doubling the interest.

The Snow Snake

This game is likewise derived from the native American Indians and to the Wabanaki tribe belongs the credit. It is played by two or more persons who skim or shoot small shafts or sticks over the hard or frozen crust of snow— similarly to the way in which stones are skipped over the water. The stick or "snake" may be thrown like the stone, but the Wabanaki slightly crouches, with the left palm over the left knee, the stick resting on the knuckles of his hand, about 1 ft. from the head of the stick. The end of the shaft is held against the first and second fingers of the right hand, and is sent on its course by a quick and forcible shove of the right arm accompanied by the forward swing of the body

Throwing the snow snake so that it will skip over the snow like stones thrown on the surface of water

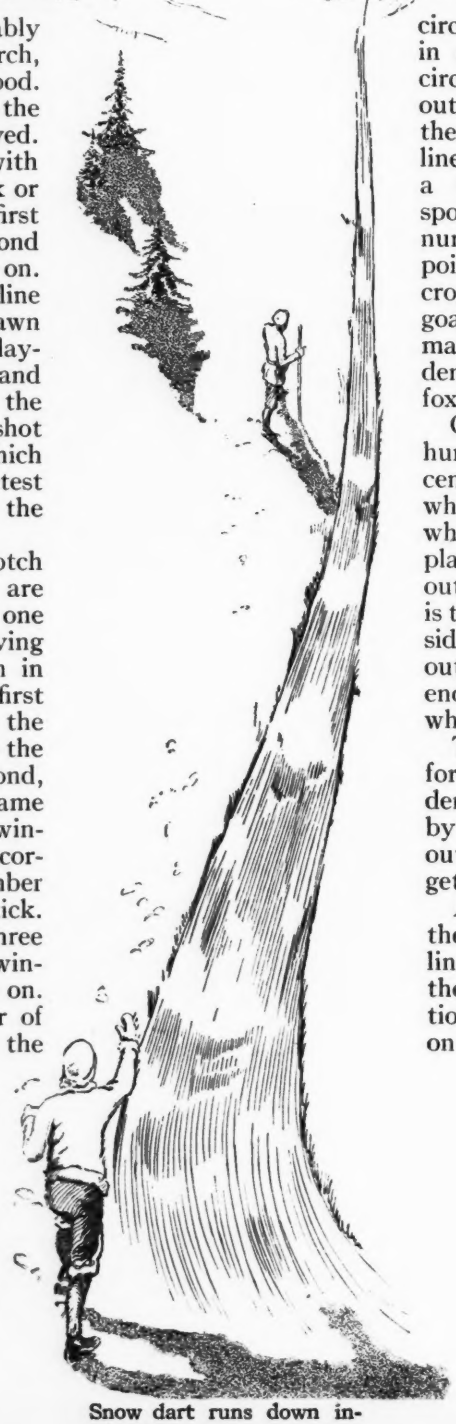
Short lengths of branches are sometimes used, but the sticks of the Indian boys are about 3 ft. long, tapering from about ½ in. in diameter at one end to 1 in. in width at the head. The sticks should be smoothly



rounded and are preferably of ironwood, hickory, birch, or other rather heavy wood. The larger end or head of the snake is often slightly curved. Each player is provided with five sticks and each stick or snake is marked—the first with one notch, the second with two notches, and so on.

To play the game, a line for the take-off is drawn across the snow. Each player stands on the line and takes turns in shooting the sticks. When all have shot the first shaft, the one which has traveled the greatest distance scores for the thrower one point.

After all the one-notch snakes are shot they are gathered and placed at one side, and the snakes having two notches are thrown in the same way as the first round. The winner of the first round is entitled to the first throw in the second, which is scored in the same manner, except that the winner scores two points, corresponding with the number of notches on his stick. When the stick with three notches is thrown, the winner scores three, and so on. While a certain number of points may determine the duration of the game, the Indian game ends when all of the five sticks have been thrown.



Snow dart runs down incline by its own momentum

Double-Rim Fox Trail

This is a particularly good chasing game for three or more persons to play over the snow. As shown in the illustration two circles are marked off—the outer circle being about 40 ft. in diameter and the inner circle 10 ft. smaller than the outer one. The circles are then bisected with straight lines, similar to the spokes of a wheel, the number of spokes depending on the number of players. At the points where the outer spokes cross the outer circle, the goals or dens for the foxes are marked off, allowing one less den than the number of foxes.

Choose a player for the hunter, who stands in the center, at the hub of the wheel. The other players, who are the foxes, take their places in the dens around the outer circle, except one, who is the odd fox; he stands outside the den anywhere on the outer circle. This odd fox endeavors to steal a den wherever he can.

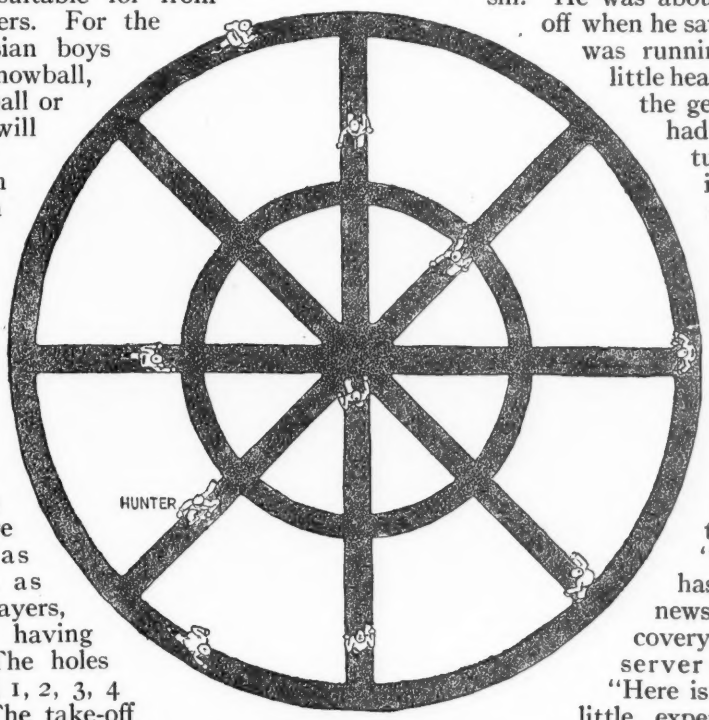
The object of the game is for the foxes to exchange dens without being caught by the alert hunter and without allowing the odd fox to get a den.

All players must keep to the trails and run only on the lines of the diagram, but they may run in every direction on either of the circles or on the spokes of the wheel. It is not allowable for a fox to turn back on his trail, and once started he must continue to the next den. When the hunter tags a fox, the two change places. When played in deep snow, paths marking out the circles and spokes should be trodden down and well packed for the game.

Russian Hole-Ball

From Bessarabia—once a province of Turkey, but now a part of Russia—comes this interesting game. It is one of the few ball games which may be played in the snow and is suitable for from 3 to 10 players. For the ball the Russian boys use a frozen snowball, but a tennis ball or even a stone will serve as well.

As shown in the illustration a number of holes are made in the snow, large enough to hold the ball. These holes are placed in a straight line and spaced 3 ft. apart. There should be as many holes as there are players, each player having a number. The holes are numbered 1, 2, 3, 4 and so on. The take-off or throwing line, is drawn across the snow 10 ft. from the first hole, and at right angles with it. There the players line up.



The double rim fox trail over which the chase is carried on

Player No. 1 stands on the line and endeavors to throw the ball in one of the holes. If the ball falls in hole No. 3 the player scores three points, and player No. 3 takes his turn at tossing the ball. If the ball lands in hole No. 2, it scores two points for the thrower, and it is No. 2's turn to toss the ball. The game is sometimes played by score—the player who first wins fifty points winning the game; but it may be varied by setting a time limit of say fifteen minutes, the winner being the player scoring the most points during this time.

Testing the Quality of Leather Belts with Vinegar

PLACE a small strip of the leather belt in strong vinegar and if it is of good quality it will not change except to turn a darker color; but if of poor quality the fibers will swell and become gelatinous.

The Law of Retribution in the Insect World

ONE day on entering his study an old gentleman noticed that there was some powdered sugar spilled on a window sill. He was about to brush it off when he saw that an ant was running around the little heap. "Ah!" said the gentleman, who had a scientific turn, "I wonder if that ant is a scout?" After a few more turns, the ant suddenly wheeled away from the sugar, ran to the outer edge of the sill and disappeared over the edge. "Probably he has gone to carry news of his discovery," said the observer to himself. "Here is a chance for a little experiment." He then brushed all the sugar off the window sill, rubbed the place with a dampened cloth, then wiped the spot over with a little ammonia, so as to leave no trace or odor of the sugar. Then he drew up a chair and sat down to watch the result.

Before very long a large party of ants appeared, lead as he believed by the one who had made the discovery, and was not content to enjoy the feast alone. They advanced to the promised land and then confusion began. They ran hither and thither, searched all about, gathered in a group and then—fell upon their guide and slew him. That was long ago, but the man who tried the experiment could not get it out of his mind. Here an honest hard-working, unselfish ant, who did not even pause to enjoy the treasures he had found, who hastened away to report his find for the public good, was deceived, betrayed, martyred—merely to answer a foolish scientific inquiry. Surely it was a case where virtue was not its own reward, where innocence was a victim.—TUDOR JENKS.

A Model Darkroom

The average bathroom may be made to serve the purpose for the amateur

By Wheeler P. Davey

A VERY small town has few accommodations for helping the amateur with his developing and printing. The tendency of the American people is to have their work done rather than to do it themselves, and this is one reason for the existence of the professional film-developer. Another is a lack of adequate darkroom facilities on the part of the amateur photographer.

It is the purpose of this article to give the principles which govern the arrangement of a good darkroom and to illustrate those principles by a detailed description of two darkrooms which have proved satisfactory enough to be called "model" darkrooms.

In planning a darkroom, space must be provided for the stock developer solution, developing shelf, sink, hypo bath, wash-tank, drying-rack, shelf for plate-holders and printing-frames, ventilating-fan, necessary lights and switches.

In addition to the foregoing it is usually desirable to provide room for a moderate supply of plates, films, printing paper and chemicals.

The room should be planned so as to make everything as compact as possible. The less one is compelled to walk about in the dark the more attention can be paid to the actual work of loading, developing and printing, thus reducing the tendency to make annoying errors. If possible the room should be so arranged that everything can be reached by taking not more than one step. If, because of the shape of the room, this proves impossible, then everything should be arranged so that it is necessary only to walk along a straight line.

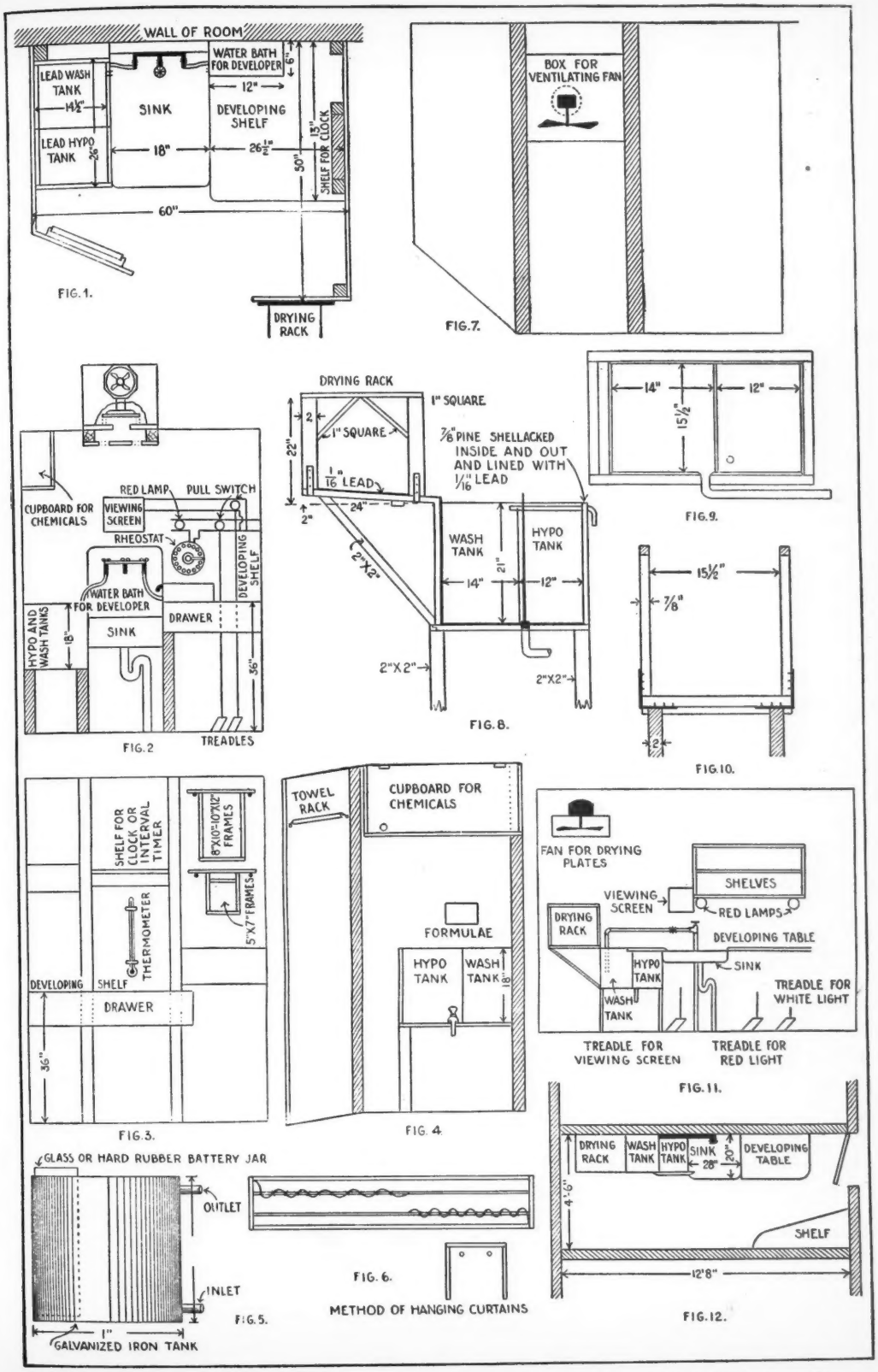
It is absolutely essential that the developer should be kept free from hypo. Hypo usually finds its way into developer in one or more of the following ways: Hypo solution when spilled on the floor, dries, and is distributed about the room like ordinary dust; the hands wet with hypo and handling the bottles of developer leave traces of hypo; electric lights are turned on while the hands are still wet with hypo, the hypo dries and is distributed as before; the fixing tray is used by mistake as a developing tray. This is especially likely to happen when the hypo tray is kept underneath the developing-shelf. With such an arrangement, the plate or film cannot be taken from the fixing-bath to be washed without dripping hypo on the floor. This source of trouble disappears when the fixing-bath is on the same level as the developing-shelf. The plate or film is thus taken out of the developer, rinsed over the sink, fixed, and washed either in a wash-box or in the sink without ever being held over the floor. By having the sink between the developing tray and the hypo, the hands may be easily rinsed off before commencing to develop the next plate or film.

To prevent hypo being transferred to switches these may be turned on and off with foot treadles. These treadles are connected by stout woven cords to pull-switches such as can be obtained from any electrical dealer.

In professional and semi-professional work, where plates are used to the exclusion of films, it will be found of advantage to use nickel-plated metal frames for fixing, washing and drying the plates. As soon as the plate comes from the developer it is put in a frame, washed in the sink and at once put in the hypo-tank. After fixing, it is washed in the wash-tank and hung on the rack to dry. The use of the frames will be found to keep the gelatin from being marred by finger-prints. In case films of fairly large size are used, these frames should be replaced by those sold for the purpose.

Plans are given of two darkrooms. By slight modifications of one plan or the other the average bathroom may be made into a serviceable and up-to-date amateur darkroom.

The darkroom shown in Fig. 1 to 7 is designed for use with films and plates up to 10 by 12 in. in size. The developing-shelf should be covered with a sheet of galvanized iron so as to prevent water



Plans of two dark rooms, one for the amateur and the other for the professional photographer

and developer from soaking through to the drawer below. The use of a water-bath for keeping the developer cool will be found a great convenience. It will be noticed that the running water in the wash-tank is in contact with the hypo-tank, thus insuring cold hypo. In case it is intended to work with only small plates or films the hypo and wash tank shown in Fig. 1 to 4 may be supplanted by the one shown in Fig. 5. This consists of a galvanized-iron tank 1 ft. square and 1 ft. high, which serves as a wash-tank. In this, at one end, is placed a glass or hard rubber battery jar such as may be obtained from any of the larger electrical dealers. This jar serves as a hypo-tank.

The rheostat, Fig. 2, is a 300-ohm rheostat of half-ampere capacity and has all the range needed for dimming a 50-watt red lamp. If a "dimalight" is obtainable it will be found to be a satisfactory substitute for the rheostat. Care should be taken to paste a piece of black paper over the tip of the red lamp as the tips of such lamps are often uncolored, allowing white light to penetrate into the room.

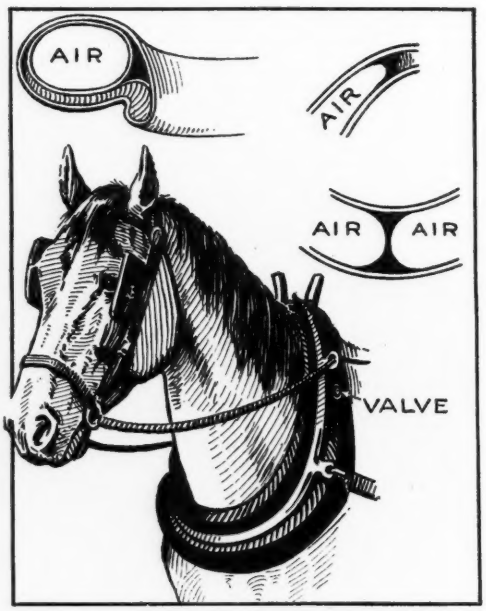
In Fig. 2 the white light is shown as a 100-watt Mazda C-2 lamp behind a ground glass. It therefore serves both as a white light and as a diffuse light for printing.

Attention is called to the use of curtains in the doorway as a means of economizing space in case the darkroom is built out like a closet in a large room. Two curtains are hung on separate rods as shown in Fig. 6. The outside edges are fastened permanently to the doorway. The inside edges are fastened to sticks about 1 in. square. These sticks act as weights and prevent the curtains from blowing in and out, causing light-leaks. Each curtain is wide enough to stretch completely across the doorway. A suitable housing as shown, painted black on the inside, prevents light from leaking over the top of the curtains. The curtains are made of double thicknesses of galatea. Such a closet darkroom requires artificial ventilation or it soon becomes unbearable. An adequate scheme for ventilation is suggested in Fig. 2 and 7.

The second darkroom is more elaborate and is more adapted to professional use. The tanks and their arrangement are shown in Fig. 8, 9 and 10. The cost of construction may be reduced by substituting the hypo and wash tank shown in Fig. 5. Attention is called to the method of drying the plates with the fan. The hypo and wash tank is shown in detail so as to be a guide to any who may care to construct a similar one. In Fig. 11 the switches governing the various lamps are not shown. The treadles will, however, indicate where these switches should be placed. In Fig. 12 is shown the general arrangement of tanks in a closet darkroom.

A Comfortable Collar for the Horse

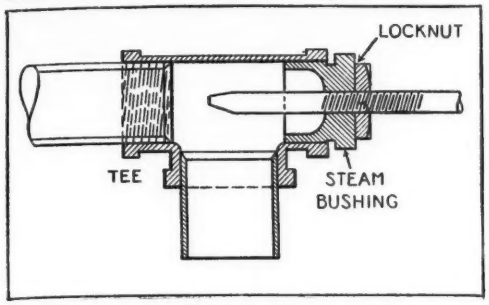
PADS used in the construction of any article add proportionately to its weight and in the making of horse collars the added burden is considerable; yet it is quite necessary to have sufficient padding against the horse's shoulder as a protection. The latest type of a collar made abroad is a pneumatic pad, built up similar to an automobile tire. Each side of the collar is a chamber of suitable shape to receive an inner air tube, which is blown up with a tire pump. Not only is the collar lighter than the ordinary one but it will fit better on the neck of the horse.



Air cell substitute is more comfortable than the stuffed pads in a horse collar

Making an Ejector of Pipe and Fittings

AN ejector is a difficult device to make and get the right proportions for delivering water at different temperatures. One made with dimensions given will lift



Pipe connections to form an ejector for water of different temperatures

hot water. The suction and delivery pipes are 2 in., turned into a tee as shown, the other opening being fitted with a reducing bushing to admit a ¾ or 1-in. pipe for steam. This pipe should be drawn to make a hole at the inner end not over ½ in. in diameter. The end of this pipe should have a long thread cut on it for adjustment and a lock nut fitted to hold it in place when set.

A Sharpening Block for Putting Keen Edges on Tools

CHISELS and plane-irons generally have a wire edge after being sharpened on a stone. This is best removed by rubbing on leather. Glue an old piece of leather belt on a small block and it will answer the purpose admirably.

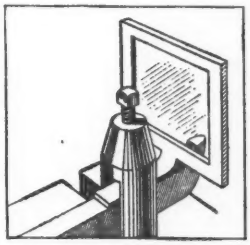
How to Drill Holes in Glass with a File Point

HOLES may be drilled in glass in the following manner. Take a pointed, three cornered file and dip it in pure turpentine. Put the point of the file at the place where the hole is to be drilled and twist the file first in one direction and then in the opposite direction, bearing lightly upon the file. Slightly turn the handle of the file around in the hand and twist it some more. When no glass is cut add more turpentine. After the hole is drilled through it can be smoothed with emery cloth.

Holes may also be put in very thin glass. Take a rod the diameter of which is the same as the diameter of the hole to be made, and place the end at the point where the hole is wanted. Pack wet clay around the rod, and then withdraw it. Pour melted solder into the hole left by the rod. As soon as the solder is poured in, dip it into cold water and knock out the piece of glass.—LESTER REINICKE.

A Tool Post Chip Guard for a Lathe

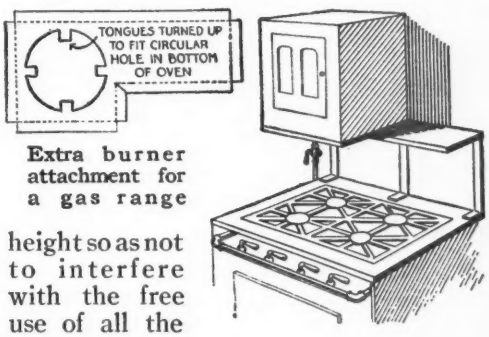
IN CUTTING some kinds of metal the chips will fly from the tool edge and are apt to strike the eye or burn the flesh. The illustration shows a guard that is easily fitted in the tool post of a lathe, where it will guard the face. It consists of a square of metal with a projecting tang the size of the tool-post slot, the square opening being covered with a piece of celluloid.



The face guard is located in the tool post

Small Auxiliary Oven for a Gas Range

WHERE cooking requirements are small the cost of heating a large oven on a gas range of the type shown may seem excessive, whereas a small portable oven set over one of the burners uses little gas. To overcome the inconvenience of storing it when not in use and of lifting it frequently, a metal shelf raised on flat iron brackets at a sufficient height so as not to interfere with the free use of all the burners, may be erected over the stove. An additional burner should be fitted into the bottom of the oven and connected to the gas supply.

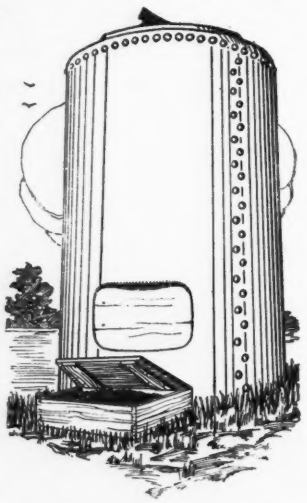


Extra burner attachment for a gas range

The shelf extending out on the side of the oven forms a convenient warming place for plates.—A. B. KENNEDY.

An Old Steam-Boiler Used As a Coal-Bin

THE owner of a discarded fire-tube boiler made use of it in a very unique manner as is shown in the illustration. The tubes were removed and the boiler set up with the ash-door opening at the bottom. The fire-door was filled in with wood, and a box was arranged at the ash-door to receive the coal as it falls to the bottom. The coal is put in at the top and settles down gradually as it is removed from time to time from the box at the base.—HAMILTON A. HOOPER.



The boiler set on end to be employed as a coal-bin

How to Protect Mounted Curiosities from Dust

MOTHS, butterflies, lichens, moss, leaves, etc., can be effectively protected from dust by a case of simple construction. Select two sheets of glass of the same size, and fasten the specimens to one sheet by a touch of glue. Then glue a strip of wood around the edge of the glass on the same side as the specimens. Next glue the other sheet of glass to the wooden strip and bind the wood with passe partout paper. Specimens will keep for years in excellent condition in such a case. To hang it, glue a piece of linen to the glass. A mirror hung in the back of the frame will reflect the specimens and add a touch of beauty to it.

Crumb Tray Quickly Made from a Candy Box

AN inexpensive crumb tray for emergency use may be made from a candy box. Take the top part of the box and break off one of the sides. Then the side may be used for the crumb scraper and the remainder of the box for the crumb tray.

Chemically Hardening and Dust-Proofing Cement Floors

A LIQUID preparation for chemically hardening and dust-proofing cement floors that have begun to crumble has recently been invented by a noted scientist.

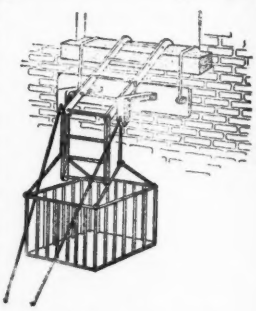
This product differs radically from the paints ordinarily used on cement floors, inasmuch as it hardens the floor through and through by a chemical reaction. It is a colorless liquid, very easily applied with a long-handled brush, which contains certain chemicals that weld the loose particles of sand and cement into a hard, solid, impenetrable mass. It does not change the color or appearance of the concrete in any way.

As this is not a mere surface coating which can wear off in time, but a preparation that changes the very nature of the concrete, its benefits are permanent and it hardens and dust-proofs cement floors for life. In factories, where the dust from cement floors gets into the intricate working parts of expensive machinery and causes serious damage, this new preparation will be particularly welcome. Moreover, it renders the floor impervious to grease, oil and dirt, so that a clean, sanitary condition is easily maintained.

An application of this preparation dries quickly so that its use does not interrupt business. If it is applied at night, the floor can be used next morning as usual.

Fire-Escape Window Bracket with Lowering Basket

THE illustration is descriptive of a fire-escape that is quickly fastened to any windowsill. A strong basket arrangement is provided in which a person or persons may be lowered to the ground by ropes. The device consists of a bracket-support with two U-shaped arms which hook over the sill of the window. To the ends of the outside extending arms are pulleys over which the ropes supporting the basket are run. A short ladder is also provided as a means of getting from the room into the basket.



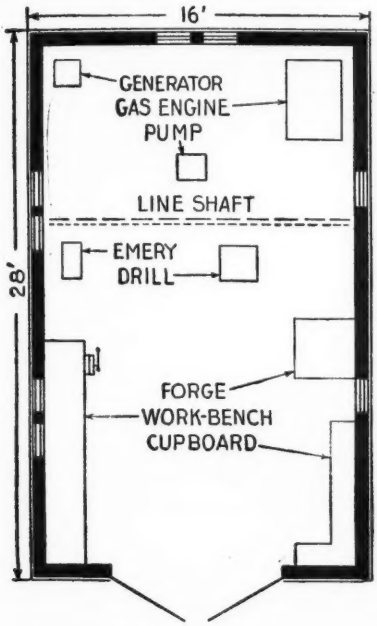
Basket and rope device for a fire escape

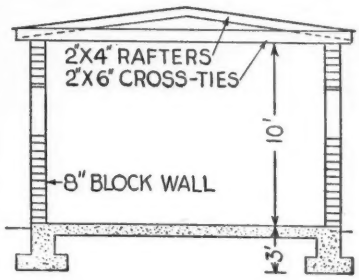
Building a Farm Forge and Blacksmith Shop

A Simply Constructed Housing for the Farm Tools

By W. E. Frudden

A SMALL homemade forge for use on the farm is inexpensive and can be constructed so that it will give very good results. A tuyere iron, a few sacks of cement and about 175 ordinary chimney bricks with some stone and sand are all the materials that will be required.

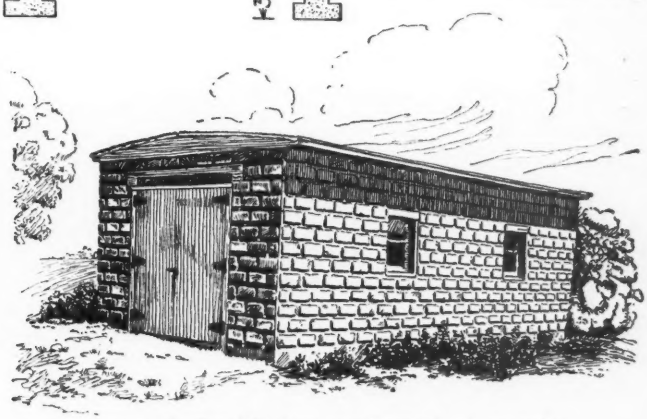




Make the forge about 2 ft. square, with a concrete foundation placed below the frost line. To do this dig a hole 2 ft. square and 3 ft. deep and fill it with a lean mixture of cement concrete. Begin laying the brick on the hardened and set cement, which should be just level with the floor-line of the shop. Lay the brick the same as in making a square flue and draw in the side until the flange or tuyere iron will rest on the inside edge of the wall about 18 in. above the ground. It is customary to have the blow pipe at the left and the shaker at the front so it will be best to use this plan in setting the tuyere iron. The brick wall is continued to the desired height and it is widened as fast as possible. Make the fire-pan 3 in. wide and 10 in deep, coat it well inside with rich cement and reinforce it with wire to prevent cracking.

A makeshift blower can be made from two old disks of a disk-harrow bolted to a wood frame in position about 2 in. apart for the sides of the blower. The fans and the cover are made of sheet metal and this is geared to an old bicycle driving mechanism. A piece of 3-in. drain-pipe is to be connected from the blower to the tuyere iron on the forge.

It will pay to purchase a good anvil that has a clear ring to it and set it on a block handy to the forge. A heavy hammer weighing 4 lb. is another one of the essential parts of the forge equipment. Anyone can then go ahead and make punches, chisels, hardies, swages, fullers and tongs. A good fire is necessary and good coal must be used. Wet the coal down well before putting it on the fire and coke it well before using it. Never let the fire become open, especially when welding work is to be done. There is considerable to learn by experience regarding work on the forge, but there is nothing about it that is too complicated for the average farmer.



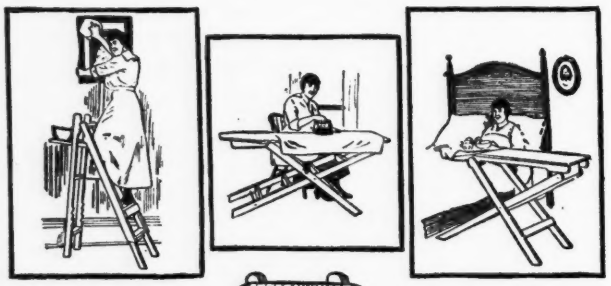
A small blacksmith shop constructed of concrete blocks, with a concrete floor in which machinery repairs can be made at times on the farm

Do not try to save money in building the

shop. Build it warm and provide for some sort of a heating apparatus. Have plenty of light and ventilation and make it a pleasant place in which to work. Provide enough room so that later on an emery wheel, lathe, drill-press and other machinery for the farm may be installed as well as a lighting plant.

Ironing-Board that Becomes a Bench and Step-Ladder

AN ironing-board which can be adjusted so that the operator may sit down to iron, and which may be converted into a bench for the tubs, a step-ladder, a sewing-table, or an invalid's table finds a use in every household. The board is made of sound lumber strong enough for all the purposes for which it is intended. When not in use it folds up so that it can be placed in any out-of-the-way corner of the kitchen, closet, or pantry.



Combination ironing board, table and step-ladder

How to Make Imitation Marble with Paints

VERY good imitations of marble can be made by the following method: Procure a tank sufficiently large for holding the articles to be treated. The articles are first given a coat of flat ground color. For gray marble, apply a coat of flat white, which is made of white lead, turpentine and a little dryer. For brown marble, add a little raw sienna and burnt umber to the ground color. After coating the articles, allow them to dry thoroughly; then sand them with No. 0 sandpaper.

Fill the tank two-thirds full of water. To secure the gray effect, take some flat white and add a little drop-black, enough to make a light lead color. With an old brush, spatter it on the surface of the water. Add a little more black and spatter it on the water. The articles, previously painted and sanded, are carefully slid into the tank. The colors floating on the water readily adhere to the flat surfaces and the desired result is obtained.

For the brown marble effect, tint the color with burnt umber, burnt sienna and raw umber. For the black, mix some turpentine with drop-black for the floating colors, using a dark lead color for the ground work. After the articles are perfectly dry, they may be sanded lightly and varnished and also polished with a little crude oil and pumice stone.

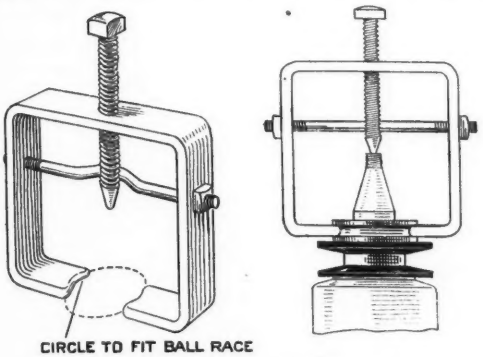
To treat marble tops, apply a coat of flat color for the ground. If in bad condition, add a second coat. When the ground color is thoroughly dry and smooth, the desired colors may be stippled on. After drying for five minutes, spatter on a solution prepared by adding a lump of potash, the size of a walnut, to a pint of kerosene. The potash cuts the colors and the oil blends them together, producing a mottled effect. With a little practice, all the different marbles may be imitated. The work may be smoothed up and finished in shellac or varnish.—JOHN L. JACKLIN.

Removing the Cones from Ball Bearings on Magnetos

THE cones or inner races of the ball bearings used for supporting armatures of ignition magnetos or small generators that supply lighting current in automobiles are not easily removed by ordinary means. The common procedure is to force these on the shaft against a shoulder. When it is desired to remove a cone for replacement, the usual method is to force this off the shaft by driving in a cold chisel between the shoulder and the cone so that it acts as a wedge. Serious damage has been done by inexperienced repairers and motorists when attempts were made to remove the cone at the collector-ring end of the armature in this manner. The slightest carelessness or slip of the chisel usually results in breaking the ebonite or hard rub-

ber insulating spool carrying the collector ring.

A simple puller may be easily made to remove cones from either end of the armature-shaft without liability of damaging



Puller for removing bearing cones on automobile magnetos or lighting generators

anything. The puller is made of bar stock, either steel or iron, bent as indicated and having the jaws shaped to conform to the curvature of the ball race and circle of the cone. A tension bolt is used to hold the puller-jaws firmly seated on the cone-ball race and prevent their spreading. This is curved or offset at the center to clear the tension screw. When the parts are properly assembled, screwing down on the puller-screw which sets in the center hole of the shaft end, will remove the most obstinate cone in an effective manner. This same type of puller, but of heavier construction, can be used to remove ball bearing cones from automobile front wheel supporting-spindles as well.—VICTOR W. PAGÉ.

Apply a Light Color to the Kitchen Walls

NEVER paint the kitchen walls a color that will not show the dirt and dust. A light color, such as light buff or a soft gray putty color is cheerful and not glaring, and it will make the owner work to keep the dirt out.

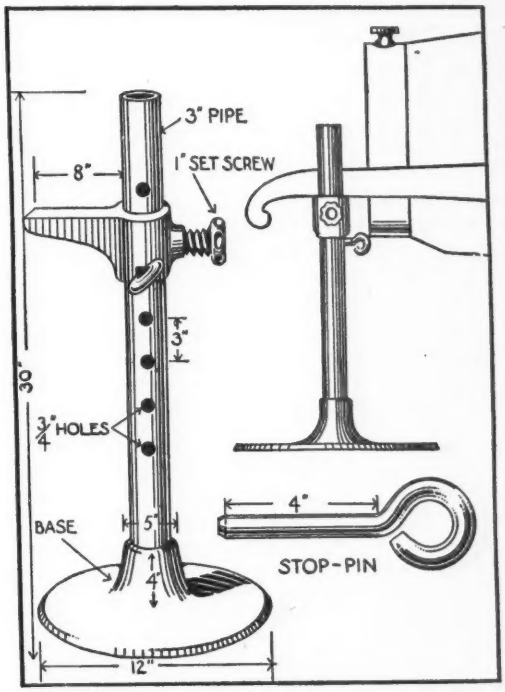
How to Make a Support for an Automobile Frame

A SIMPLE piece of garage and automobile repair-shop furniture that can be made during spare time is shown in the accompanying sketch. It is especially valuable in supporting the frame of an automobile when necessary to remove a spring or axle, as the ordinary form of automobile lifting jack cannot be used to advantage under such conditions.

The base is of cast iron, the mold being made from a simple wood pattern. The only machine work necessary is to bore out the center and tap it to fit the pipe. A pipe 2 in. in diameter will be suitable for small cars, though the 3-in. size illustrated is better adapted to general requirements of the average garage as it will sustain the heaviest pleasure cars and practically all trucks. The pipe is threaded at one end and screwed in the base-plate casting.

Sometimes an ordinary floor-plate is used by bolting it to a substantial wood block or section of plank instead of the special casting, though the latter is neater and cannot crack or split. A series of $\frac{5}{8}$-in. holes are drilled through the pipe, these being spaced as desired, usually 2 or 3 in. apart. Another casting is made for moving on the pipe. An arm projects as shown.

No machine work is needed except tapping out for the 1-in. set-screw, as the large hole through which the pipe passes may be cored in the casting to save expense. To make doubly sure and prevent liability

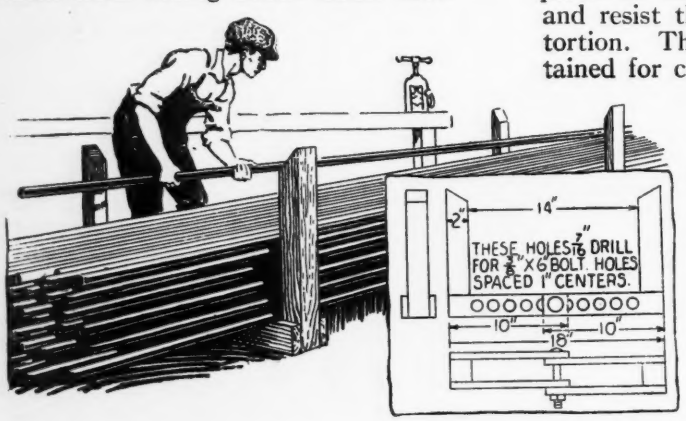


Frame support or jack to use in places where an ordinary jack is not adaptable

of set-screw slipping under a heavy load, a stop-pin is also provided, this passing through holes in the pipe and slots in the casting. This stand is useful in supporting front and rear axles for repairs and also for holding bar-stock when pieces are to be cut.

A Portable and Adjustable Holder for Storing Round Stock

IN shops or storerooms where rods, pipes and the like are kept, some kind of a rack or holder should be provided to keep them from rolling about under foot.



The uprights are adjustable to accommodate a large or small quantity of stock and can be moved from place to place

Stationary racks serve the purpose well, but they cannot be changed when a different location for the material is wanted. The holder shown has been used with success, and it was not expensive to make. The wood used was picked up about the shop and one of the men doing carpenter work put it together. One rack is required for each end of the stock.

Each standard is 18 in. long and 2 in. square, with two pieces, each 10 in. long, 2 in. wide and 1 in. thick, fastened at right angles to the lower end as shown. The horizontal pieces are spaced for holes 1 in. apart, which are bored with a bit 7/16-in. in diameter. A 3/8-in. bolt about 6 in. long is used to hold the parts together.

If only a small number of rods are to be kept, the uprights may be pushed together, closing the space between them. When the stock is placed in the holders the weight keeps them firmly in position.

Turning Small Screws in Difficult Places with a Wood Screwdriver

TAKE a piece of peg wood, or the end of a wood penholder, or match, or similar strip of wood. Shape the end into a screwdriver-bit so that it will snugly fit the screw slot. Such an improvised screwdriver will hold the screw firmly at any angle and will drive it almost home, when the process can be completed and the screw set up with a metal driver.

Finishing Aluminum Surfaces on a Buzz-Planer

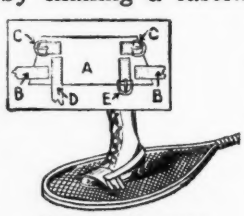
ALUMINUM is a metal that can be worked with rapid cutting machines, the only drawback being in holding the pieces so that they will stand the strain and resist the cutting stress without distortion. The practical limit thus far attained for cutting speed is 150 ft., and a manufacturer of aeroplane engines has used a buzz-planer for surfacing the aluminum oil pans that go under the engine crank-case. The walls of these cases were only 1/8 in. thick and were hard to hold in an ordinary fixture, so the buzz-planer was tried out with excellent results. While more cuts had to be taken, the speed with which each one was done made it possible to complete the surfacing in less time than in the ordinary way.

To Repair Nail-Hole Punctures in Rubber Tires Economically

IT is not necessary to paste a large patch on a small nail-hole puncture. Just as good results can be obtained in a much more economical way. Pick out the hole until there is a very clean perforation, then roughen with sandpaper. Apply the cement, allowing it to dry 25 or 30 minutes, and fill the hole with a small plug of tube-stock rolled up to fill the opening. Cure 5 minutes on the flat plate. The pressure will form the rubber plug into a sort of a rivet on the inside and the repair will hold just as well as a bulky patch.

A Snowshoe Fastener Better Than Strings

THE ordinary method of tying on snowshoes may be improved upon by making a fastener like the one illustrated. The toe-clip *A* is of light harness leather, with straps *B* for attaching it to the web of the snowshoe. The buckles *C* are for the straps *B* and the strap *D* engages the buckle *E*. This toe-clip can be adjusted even with cold fingers, in a minute's time.—J. L. BAYLEY.



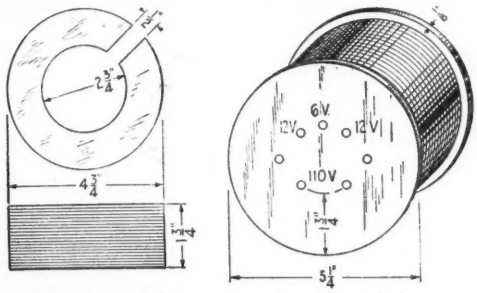
Leather fastener for snowshoes

The Amateur Electrician

And Wireless Operator

Easily Constructed Step-Down Transformer

THE greater part of the work of building a small step-down transformer is in the cutting and assembling of the iron. By securing the reactance core of a dismantled alternating current arc light there will be had a well proportioned and efficient core ready for taping and winding. These cores



A laminated iron core of a discarded arc lamp used for a step-down transformer

can be easily secured as, in a great many places, the new high powered Mazda and nitrogen lamps are replacing the old style arcs. The core I used was of the dimensions shown in the accompanying illustration.

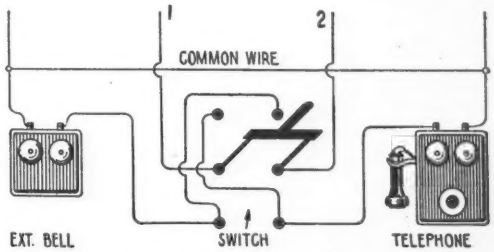
File the sides of air gap smooth and parallel; clean the iron, tape and then shellac it. When the shellac is dry wind on No. 18-gage double cotton-covered copper wire in even turns. For a maximum secondary voltage of 12 volts wind 120 turns, starting 1 in. from the opening on the inside circumference. Tape may be taken off at any turn, figuring ten turns for each volt. Wrap the secondary coil with linen tape, and cover with shellac. Over this wind 1100 turns of No. 26-gage double cotton-covered copper wire as evenly as possible. Cover the completed primary and core to the opening with black friction tape and then coat it with shellac. Cut a disk of $\frac{1}{8}$-in. fiber and bore holes for binding posts as shown. Slip a piece of $\frac{1}{4}$-in. cotton tubing or lacing over each lead and connect it to the binding posts. Fasten the fiber to the transformer by tying it with cloth tape.

The proper and efficient way to fill the air gap would be to cut small pieces of transformer iron and wedge them in place in line with the other laminations. Another way is to cut pieces of the metal $1\frac{3}{4}$ in. long by 1 in. wide, and drive them in at right angles to the core iron. This latter method causes the wedge to heat up, showing there is considerable loss through eddy currents. For most experimenters the transformer will operate efficiently enough with gap left open.—O. J. HURLBUT.

One Telephone Used on Two Lines

WHERE it is desired to use one telephone on two lines so that both lines will be kept separate and yet sound the rings from each line, the following method may be used. Connect an extension bell and a double-pole double-throw switch to the telephone and the lines, as shown in diagram.

If one of the lines is a grounded circuit, the ground should be connected to one side of the switch and not to the telephone or



Connections of telephone wires and bells for using one telephone on two lines

bells; but if both are grounded circuits the common wire should be connected to the ground.

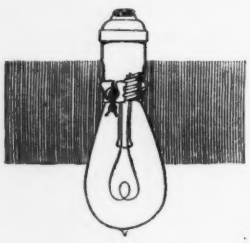
In the diagram, if the switch is thrown up, the telephone is connected to the line 1

and the bells to the line 2; if the switch is down, the telephone will be connected to the line 2 and the bells to line 1.

It is best to have the bells produce a different sound on the instruments so that you may tell by the sound which is ringing. If a small nick is filed in one of the bells it will change the tone.—A. A. DAVIDSON.

An Electric Lamp-Socket Lock Clamp and Seal

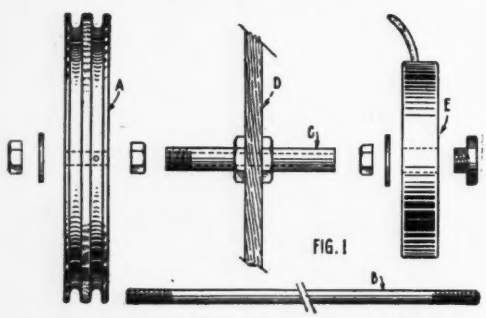
EXPENSIVE tungsten globes are apt to be a temptation to the petty thief. The illustration shows a new lock for preventing the removal of a globe from its socket. It consists of a clamping-ring that fits over the raised portion of the lower end of the socket and is held with a screw. The screw-head is provided with a three-cornered projection inside of a raised ring for a key to enter in turning the screw. Through the raised portion is a hole for a bit of wire, the kind used for seals, to be inserted. The globe cannot be removed without breaking the seal and using the key.



A sealed lock-clamp on an electric socket

A Knob-Control for an Inductively Coupled Tuner

A CONVENIENT arrangement whereby an inductively coupled tuner can be operated by means of a round knob on a panel receiving set is shown in the drawing, Fig. 1. A double-grooved pulley is represented at *A*, which is locked on the stud-bolt *B*. This bolt passes through the sleeve *C*, which is locked on the panel *D*. The handle *E* is fastened to the other end of the stud-bolt. The method of operation is shown in Fig. 2. This arrangement allows the use of a coupler which has a long slide.



Manner in which the knob is attached to the shaft to operate a long slide of a tuner

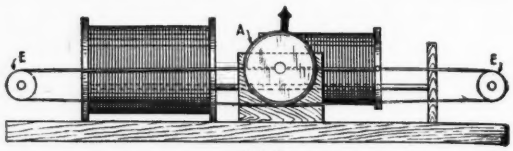


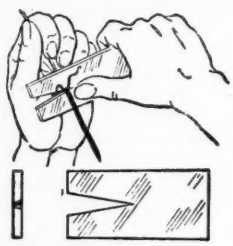
FIG. 2

The method of operation of the knob-control where the coupler has a long slide

A heavy cord is fastened to the secondary coil and passes over the two pulleys *E*. Each end of the cord is led to a separate groove in the pulleys *A*. The cord can be fastened on the pulley by drilling small holes in the flange of *A* and tying knots securely in it. The size of pulley *A* is determined by the length of the slide of the loose coupler.—D. R. SIMMONS.

Remover for Insulation on Electric Wires

TO remove, or skin the insulation from a wire, cut a V-shaped slot having curved sides in the end of a flat bar of tool steel, as shown in the detail. For practical purposes a bar of steel 3 in. long, 1½ in. wide and ¼ in. thick will be needed. Two holes are drilled below the apex of the slot for screwing the cutter to the workbench. When an insulated wire is pressed into the slot, the sharp edges cut through to the wire and its covering is readily removed by a quick pull downward. —E. B. WILLIAMS.



Removing the insulation from wires

How to Make a Portable Aerial for Wireless

A COMPACT aerial that can be carried in the pocket may be improvised from a long steel tape measure, such as is used by surveyors or building contractors. When not in use it can be rolled up into its case and carried in the pocket. Although steel does not have the conductivity of copper, such a tape has given very good results, when strung from a tree or housetop to the receiving set. Arlington has been heard clearly in New York when this kind of an aerial was employed.

How to Become a Wireless Operator

VI.—Simple Adjustments and Connections

By T. M. Lewis

SKILL in receiving, which includes both the ability to "copy" Morse and Continental signals rapidly and accurately, and facility in the adjustment of the receiving instruments, is one of the most important things for a radio-operator to develop. Knowledge of the transmitting

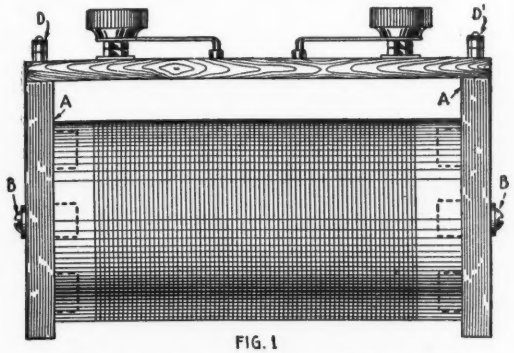


FIG. 1

A switch panel made of hard rubber or fiber is mounted to the top of the end blocks

apparatus and its manipulation, as well as a clear and firm method of handling the key in sending, is of course essential; but without knowing how to adjust the receiving tuners and detectors so as to get maximum strength signals with the least interference a wireless man soon finds himself in trouble. The only way to gain the needful familiarity is through practice with the apparatus itself; and at the same time the student must realize how and why his instruments work. Unless it is clear to him just what effect will be produced, and why, whenever he makes an adjustment or changes a setting, he will not progress very rapidly.

In the January article of this series it was shown that the detector and stopping condenser previously described could be assembled with either of two types of tuning coil (the "one-slide" and the "two-slide" varieties) so that messages could be received from commercial and naval stations hundreds of miles away. Receiving practice gained through use of receiving apparatus in the ways indicated will form a valuable foundation for further advances in the use of more complicated tuning arrangements, and the experimenter should familiarize himself with the action of the circuits shown in Fig. 3, 4 and 5 of the last article.

Methods of Connecting

The method of connection shown in Fig. 5 of the January article is the most effective of all the simple arrangements. It requires a tuning coil with two variable contacts or sliders, in addition to the usual detector, telephones, and stopping-condenser. This same tuner may of course be used for tests of the single-slider "hook-ups," by using only one of the movable contacts; such trials will demonstrate beyond doubt the fact that, when it is properly adjusted, the two-contact arrangement gives louder signals with greater freedom from interference. Somewhat more skill is required to get the best results from the two-slide than from the one-slide apparatus, but the effort is more than repaid.

Sliding-contact tuning coils for use in any of the circuits described may be purchased from the wireless supply houses, and will give reasonably good results. It is very easy to make such tuners, since all that is required is a coil about 3 in. in diameter and 8 in. in length, wound with insulated wire of about No. 22 gage and fitted with two contacts which slide along rods supported above paths from which

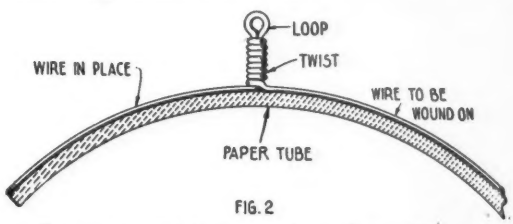


FIG. 2

The twist and loop stand up from the coil and the wire is soldered to the loop

the insulation has been scraped. Such instruments have been used in commercial radio-telegraphy, and were very common in the stations of eight or ten years ago. It has been found, however, that the sliding contact upon the coil itself is not particularly desirable, since the slider finally wears

through the wire, and there is always difficulty in maintaining good contact. Further the slider usually short circuits several turns at its point of contact, and thus causes mistuning and loss of signal strength. These disadvantages of the sliding contact, taken together with the poor circuit design often employed, have brought the direct-coupled circuit of the sort described into disrepute; there is really little choice between the direct and inductively coupled receivers, however, provided that both are properly built.

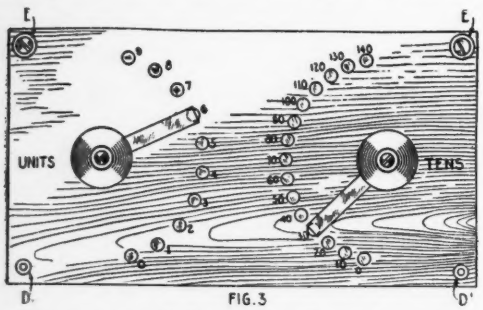


FIG. 3

The rotary switches mounted on the panel, one having ten and the other fifteen points

By making the loading and transformer coils in separate units, and fitting each with switch contacts instead of sliders, it is entirely practicable to produce a receiving installation which has all the selectivity of the inductively coupled type and still avoid some of its disadvantages. Such coils are described below, and their mode of connection is shown in Fig. 7, which corresponds to Fig. 5 of the December article.

The Loading Coil

This instrument is shown in Fig. 1. The basic piece is a paper tube of about 4 in. diameter and 8 in. length. Beginning about 1 in. from one end, No. 20 gage double silk-covered magnet-wire is wound on evenly for about 6 in., which will take 149 turns. A tap must be taken out for each of the first ten turns, and one for each tenth turn thereafter, as shown in Fig. 4. The best plan is to fasten the end of the wire, before beginning winding, through two small holes punched in the paper tube, leaving about 2 in. of wire free for the tap marked "9" in Fig. 4. Then a single turn is wound on, and a small loop twisted in as shown in Fig. 2. This twist and loop stand up from the surface of the coil, and the wire leading to contact "8," Fig. 4, is later soldered to the loop. The second turn of wire is then wound on the tube, and another twisted loop for the contact "7" is made. Thus a twist is put in for each of the contacts, at the end of each turn, till that marked "O" is reached. Then ten turns are wound without a tap, the twist for "10" being taken out at the 19th turn of the whole coil. Similarly taps for "20", "30", etc., are made at each tenth turn thereafter.

The completed coil is to be mounted between two end blocks of wood or hard rubber, *A*, in Fig. 1. Three small pieces are fastened to the inside faces of each of the end blocks, as shown in dotted lines, to keep the coil from slipping sidewise; and the whole is held together by a piece 1 in. square passing through from end to end in the center of the coil. Screws *B*, with washers under their heads, pass through holes bored in the end blocks and clamp the tube by threading into the ends of this central stick.

As further shown in Fig. 1, a switch-panel is mounted on top of the end blocks. This should be made of hard rubber or fiber, about ¼ in. thick, though hardwood ⅜ or ½ in. thick will do. It is fastened to the end blocks by means of two wood-screw binding posts *D*, D^1, Fig. 1 and 3, and the screws *E*, Fig. 3. On it are mounted two rotary switches, one having 10 and the other 15 points, as shown in Fig. 3. Any type of switch-arm will do for these, but the easiest manipulation will be obtained if a center-knob type is used.

The 10-point switch should be marked "Units" and the 15-point "Tens"; the buttons are to be numbered from zero to 9 for the former and from zero to 140 in tens for the latter. The taps from the coil itself are to be connected with these switch-points by means of short soldered leads, as shown in Fig. 4. Great care must be taken to see that no short circuits are made as this wiring is put in place. The central points of the switches, i. e., their arms, have wires leading to the binding posts

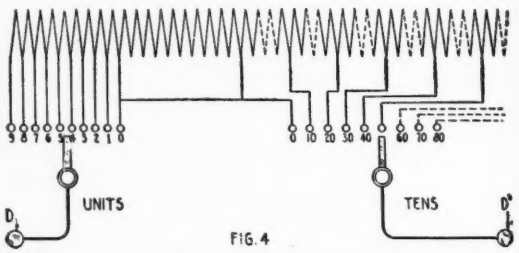


FIG. 4

The wiring diagram for the loading coil showing the turns and where they are tapped

D, *D*[1]. It is best to make the switch buttons marked zero the lowest; then as the switch-arms are turned toward the upper positions, more and more turns of the coil are cut into the circuit between

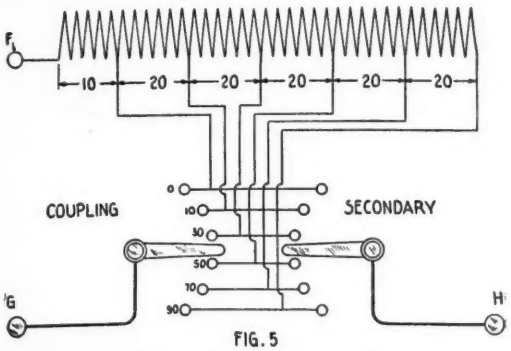


FIG. 5

The transformer coil wiring diagram showing only eight taps taken from the turns

the two binding posts. As is obvious from the diagram, the "tens" switch cuts in ten turns at a time, while the "units" switch gives steps of a single turn. By various combinations of both switches, any number of turns from 1 to 149 can be had.

The Transformer Coil

Another coil very much like the first is now to be built. The mechanical features are exactly the same; but only 8 twisted taps are taken out from the 150 turns of No. 20-gage wire. The end of the wire is connected to a binding post *F*, Fig. 5, and taps at the tenth, thirtieth, fiftieth and each twentieth turn thereafter are led to the corresponding points of two nine-point switches mounted on the panel. These are marked "Coupling" and "Secondary" respectively, and take the places of the 10-point and 15-point switches on the loading coil just described. Their buttons are marked 0, 10, 30, 50, and so on to 150, in steps of 20 turns, and the soldered connections are made as shown in Fig. 5. The binding post *F* may take the place of one of the screws *E* in Fig. 3, and the posts *G* and *H* are located as *D* and *D*[1] in Fig. 1.

It is to be noted that in the loading coil the adjustment of inductance may be had in single turn steps by the use of two switches, but that there are only two points of connection. In this last described coil there are three points of connection, two of which are variable in steps of 10 and 20 turns from 0 to 150. Thus the two coils, while superficially alike, may be used for very different purposes.

Switches

It is possible to buy lever-switches from the various supply houses, but usually the type with the knob at the outer end of the switch-arm is furnished. This is not nearly so convenient for tuning as the kind with central-knob shown in Fig. 1, 3 and 6, since considerably greater movement of the hand must be made in order to accomplish a given adjustment. Central-knob switches are not difficult to make; a simple and effective design is shown in Fig. 6. The switch-points *I* may be of any sort whatever; most supply houses will sell these for one or two cents apiece. The switch-arm *K* is cut out of thin spring-brass, and is formed of two pieces, each having one end punched to fit over the machine-screw *O* and the other end bent down to make smooth contact with the buttons *I*. The arms are fastened to the turned hard rubber knob *L* by means of the brad or escutcheon pin *M*, and are further clamped by the two nuts *N*, *N*[1]. The central machine-screw *O* passes through the switch-panel *Q* within a short sleeve *P* and through two washers shown but not lettered. Two additional nuts *N*[11] and *N*[111] are clamped on the inside, just enough play being allowed for free turning when the arm *K* bears upon the contact points. Connection to the arm is made through the spiral *R*, the free end of which is soldered to the screw *O*. Soldered connection is made to the switch-points at *J*.

Setting Up the Receiver

The loading coil and the transformer coil as described above are to be combined with a detector, telephone set and stopping-

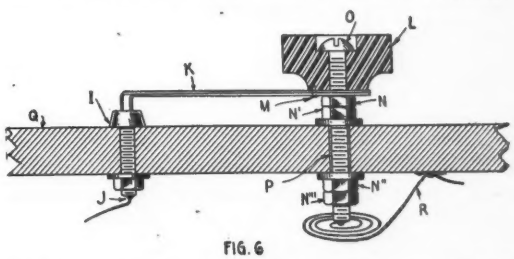


FIG. 6

Diagram of the central knob used on switches. It is very effective and not difficult to make

condenser as shown in Fig. 7. The antenna circuit passes through the loading coil from *D* to *D*[1] and thence to binding post *G* of the transformer coil. This leads to the "coupling" switch, and the circuit runs from there through whatever part of the coil is cut in, and out to ground through

binding post *F*. The secondary circuit includes that part of the transformer coil cut in by the "secondary" switch, and runs from binding post *H* through the detector and stopping-condenser to the ground binding post *F*. The telephones are connected across the stopping-condenser.

A crystal detector and stopping-condenser suitable for this use were described in the POPULAR SCIENCE MONTHLY for November, 1916, in the third article of this series. The proper sort of telephones to use was also discussed in that article. A test-buzzer arrangement for adjustment of the detector was explained in the December article, and should be combined with the outfit of Fig. 7 in order to make the adjustment easier and more positive.

Tuning

The circuits of Fig. 7, with the apparatus described, will give excellent results in receiving from the commercial and naval spark stations, if used with an antenna of from 150 to 250 ft.

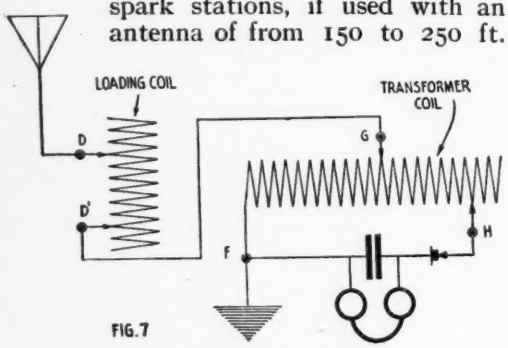


FIG. 7

These circuits with the apparatus described give excellent results in receiving

length. For shorter wavelengths than 500 meters the antenna used should be somewhat shorter, and for waves longer than 2500 meters (that on which time signals are sent) it is advantageous to use still longer wires. It is not necessary to erect multiple wire aerials for receiving, nor is great height essential. A 200-ft. single wire, of No. 10 gage copper, or even galvanized iron, swung horizontally between two 50-ft. masts or trees, will prove entirely satisfactory for most purposes. When it is desired to receive the short waves from amateur stations, which are restricted by law to wavelengths under 200 meters, a wire not much over 70 ft. in length should be used.

In attempting to "pick-up" signals with the outfit of Fig. 7, the best plan is to set the "units" switch on 5, the "coupling" switch on about 30, and then to vary simultaneously the "tens" and the "secondary" switches. As the turns on the loading coil are increased in number, those of the secondary should also be increased. When signals are heard, the best point of the secondary is selected, and the loading coil and coupling switches adjusted to give the loudest responses. One must of course be careful that his detector is adjusted properly before starting to tune; for this purpose the test-buzzer is a great time-saver.

It will be noted that more turns of the loading coil and of the secondary are needed for long wavelengths than for short ones, and that when the number of "coupling" turns is reduced, the number of turns in the loading coil must be proportionally increased. This is because the loading coil and the coupling turns in series form a primary circuit, whose effective length must be adjusted for the various wavelengths in the manner described last month. It will also be noted that all stations which have the same wavelength will "come in" best with approximately the same settings, and that the wavelength of any station may be estimated roughly by considering the number of turns in the loading and coupling coils which give the strongest signal from it.

A thing which is very important in the operation of this tuner, however, is not likely to be evident from the first tests made upon it. That is the relation between the sharpness of tuning and the number of turns on the coupling part of the transformer coil. Careful observation will bring out that when the number of turns on the coupling section is reduced, and the loading coil correspondingly increased to the tuning point, better selectivity is obtained. Usually there is a best value of the coupling turns for every station or wavelength, and its use requires the proper corresponding settings of the loading coil and secondary switches. Often when there is interference it is best to use still fewer turns of the coupling section, correspondingly increasing the loading coil, so as to get sharper tuning in spite of a weakened signal. The judicious selection of values for these three coil sections (primary, coupling and secondary), and the proper balancing of signal strength against sharpness of tuning, is one of the items which is most important in commercial radio-telegraphy. Many operators fail to get the most out of their receivers merely because they fail to pick out the best

adjustments, or because they do not retune primary or secondary circuits after changing coupling values. Practice with the apparatus of Fig. 7 should make the desirability of correct tuning evident to every experimenter.

In the next article of this series there will be discussed the secondary variable condenser. When properly used, this instrument is of great value in increasing sharpness of tuning.

An Easily Made Adjustable Telephone Condenser

A CONDENSER which has the advantage of easy variability and interchange of units may be made as follows: Secure a number of burned-out cartridge fuses and take the caps off very carefully, being careful not to bruise them. Clean out the insides thoroughly, and open the holes in the caps so that you may solder the internal leads to them.

Cut some tinfoil strips 1¾ in. wide and of length to be determined by the capacity of condenser-units you desire. Prepare also some strips of paraffin-impregnated paper about ½ in. wider than the foil and about 1 in. longer. Lay down the paper on a smooth surface, and on it place a strip of foil (see Fig. 2) with a piece of stranded copper wire attached to the end for connection. Put a second strip of paper on top of the foil, and then another strip of foil. Fasten a wire terminal to this second foil piece, taking it out in the other direction

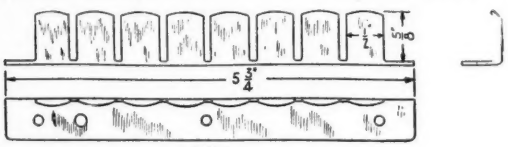


FIG. 1

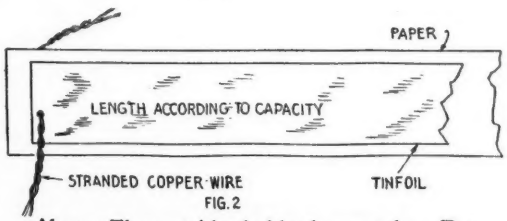


FIG. 2

Above: The cartridge holder brass strip. Below: Strips of tinfoil on the paper before rolling

as shown. Now roll up the whole four strips as tight as possible and tie the roll with thread. Soak the rolled unit in melted paraffin until no air bubbles can be seen.

Next insert each rolled condenser into a fuse-tube, with one of the connecting wires projecting out of each end. Run these wires through the holes in the caps, and solder. This completes the condenser-units. The capacity, or the number of square inches of tinfoil, should be marked.

A holder for the cartridges should be

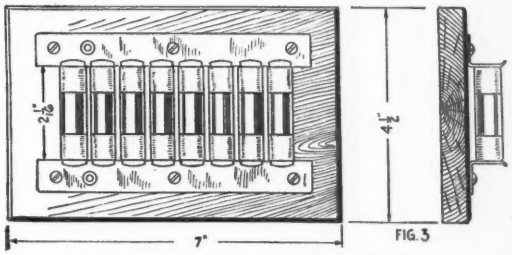


FIG. 3

The cartridges filled with the rolls of tinfoil and mounted on the holder or base

made by bending and cutting two strips of 1/32-in. spring brass or copper, about No. 20 gage, each of which is 5¾ in. long and 1¼ in. wide, as shown in Fig. 1 and 3. Additional dimensions and the method of mounting are shown in the drawings.

How to Keep the Telephones from Humming

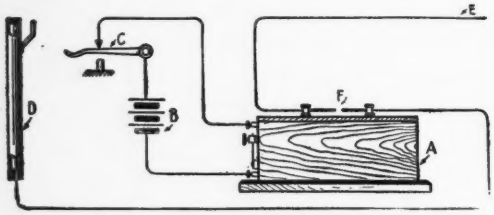
AMATEURS who have alternating current in their homes and a droplight near the instruments are usually bothered by a 60-cycle buzz in the telephones. This is very unpleasant when receiving weak signals from a distant station. It will be noticed that by putting the hand near the lamp-cord the sound of the buzz is increased, but when the hand is placed around the cord the sound ceases entirely.

Evidently the body acts as a conductor between the line and the ground. The following remedy has proved very satisfactory.

Wind one or two layers of No. 18 or No. 24 cotton-covered wire around the lamp-cord for about 4 or 5 in., keeping them as close and compact as possible. The other end of the wire is then connected to the instrument ground-binding post or some other ground connection as near to the instrument as possible. A telephone or other condenser of 1 or 2 M. F. connected in series with the wire and the ground also gives good results, and if desired, two telephone condensers may be connected in multiple, for the more capacity the better. Do not let the cotton-covered wire touch the socket, as there may be something wrong inside. This method is not good for preventing a buzz caused by arc-lights or other outside circuit.—D. BROWNE.

An Electric Gas Lighter for the Kitchen Range

THE illustration shows the necessary parts and a wiring diagram for making an electric lighter for the gas range. A ½-in. spark coil *A* is con-



Spark coil and its connection for lighting the gas by electricity

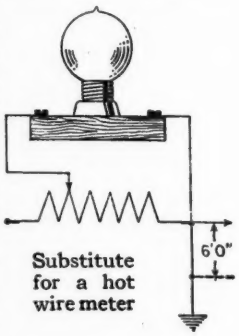
nected in line with the battery *B* and to an old telephone hook *C*, for the primary coil; the secondary is connected to a piece of fiber tube *D*, which is ¼ in. inside diameter with a piece of ¼-in. brass or iron rod driven into it, allowing one end to extend ¼ in. A heavy insulated flexible wire is soldered to the other end and the space filled with paraffin or other insulating material. If this wire is properly fastened to the end of the tube, the handle piece thus formed can be suspended from the telephone hook when not in use.

The other end of the secondary wire *E* is fastened or grounded to any metal part of the stove and a ½-in. gap is made at *F* on the coil. When the fiber tube is taken from the hook it will close the primary circuit and a spark will jump the gap *F*, but when the end of the rod is placed near the burner on the stove a spark will issue therefrom and the gas will be lighted. The whole outfit can be inclosed in a neat box with the telephone hook extending, the box being placed on the wall near the stove.

A Reliable Radiation and Tuning Indicator

THIS arrangement acts as a radiation indicator and serves the same purpose as the hot wire meter, except that it is less delicate. It does not interfere with the oscillations, and can be left in circuit continuously. The connections are shown in the drawing. The coil is constructed like a helix, and contains about a dozen turns of No. 8 wire wound on a form 3 in. in diameter and spaced ¼ in. apart. A movable contact is provided as shown. The lamp used is a small four or six-volt carbon filament bulb, which may be obtained from any supply house. When the transmitter is in operation the lamp lights up. The coil is connected in shunt around six or more feet of the ground wire from the transmitter. The proper length must be determined by experiment. Only a small part of the high frequency current is passed through the coil by this arrangement.

To find the adjustment for maximum radiation at a desired wavelength, place the slides of the indicator coil so that all the turns are in circuit and adjust the antenna circuit inductance until the lamp lights up the highest. Now decrease the number of turns on the indicator coil, thus decreasing the brilliancy of the lamp, and re-adjust the transmitter circuits for the brightest light. Continue this process until the lamp lights up brilliantly with the least possible number of turns on the indicator coil. The transmitting station will then have a maximum radiation for the given wavelength.

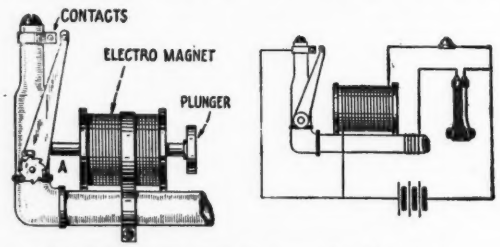


Substitute for a hot wire meter

This will be welcomed by those wireless amateurs who could not make, or who had not the means to purchase a hot-wire meter.

An Electric Gas Lighter Operated with a Push-Button

HAVING one of the single pull chain electric gas lighters I decided to change it into one that would work with



An electro-magnet to operate the contact points for making spark on gas tip

a push-button, and I accomplish my purpose by making the simple arrangement illustrated. The single chain type, as is

well known, utilizes a ratchet arrangement to turn on and off the gas. The first pull turns it on and lights it, the second extinguishes the light by shutting off the gas.

Instead of actuating it by hand an electromagnet was made and mounted on the gas jet as shown. This magnet was wound on a brass tube ½ in. in diameter and 2 in. long. Six layers of No. 24 gage wire were wound on it. The armature is a length of ½-in. soft iron rod, to one end of which a disk ¾ in. in diameter is fastened by means of a machine screw. The chain arm was cut off as at *A*.

The regular gas lighting equipment consisting of battery and kicking coil was used. The battery consisted of four dry cells and the kicking coil was made from 1 lb. of No. 22-gage soft iron wire 6 in. long and covered with No. 18 insulated wire. The coil wire is made into a compact bundle and carefully insulated. Two heads are cut from ¼-in. stock. The winding consisted of 6 layers of No. 18-gage wire—about 1½ lb. being required. These were connected in series to the break mounted on the gas jet. Shunted across the battery was the solenoid and a push button.

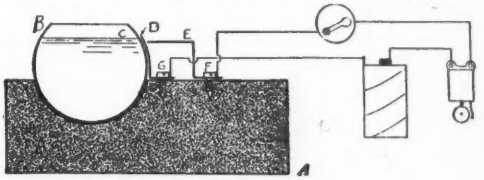
The operation is very simple; pushing the button energizes the magnet, drawing the core in, which pushes the contact arm over. The ratchet turns on the gas and as the contact arm passes the contact on the stem of the fixture a spark is emitted when the circuit is broken, due to the high inductance of the kicking coil. When the button is released the arm flies back and the gas remains lit. A second push on the button will put the light out. This apparatus can be installed at much less cost than the usual automatic lighters, and it will be found to work equally as satisfactorily.—Thos. W. Benson.

Measurement Units of Wireless Telegraph Inductance

Wireless telegraph inductances are usually measured in either millihenrys, microhenrys or centimeters. Each of these units is a subdivision of the fundamental practical unit which is named in honor of the great electrician Henry. One millihenry is equal to one thousand microhenrys, and one microhenry equals one thousand centimeters of inductance.

An Electric Circuit for a Freezing Alarm

With the simple device illustrated an alarm will be given when the temperature reaches the freezing point.

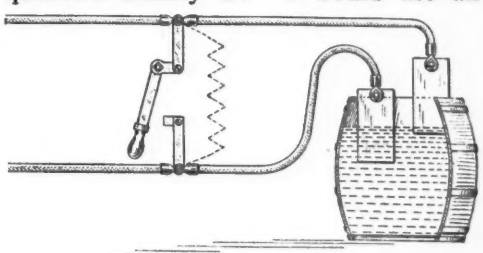


The expansion caused by the freezing of the water makes the electrical contact

A block of wood 4 in. long, 3 in. wide and 2 in. thick makes the base *A*. A small hollow rubber ball *B* is glued in block *A* with about one-third of the top cut off. A very thin strip of sheet copper *D* is placed against side of ball *B* and fastened to base *A* with screw *G*. Another piece of thin copper *E* is placed on the base by means of a screw *F*. This piece of copper should come within 1/32 in. of touching the copper *D*. The ball *B* is then filled with water, to *C*. When the temperature becomes freezing a thin coat of ice freezes over water *C* in ball *B*, causing the rubber ball to expand and push copper *D* out against copper *E* which closes the circuit.—Wm. Harrier.

Makeshift Motor Starting Box for Burned-Out Rheostat

One of the questions that is often put to applicants for commercial radio licenses is: "In case your motor starting rheostat should be damaged beyond repair, what would you use as a substitute?" The answer to the question usually is: "I would use an



Iron plates suspended in an acidulated salt water solution for a starting box

iron pail filled with a solution of salt or slightly acidulated water and an iron rod or plate."

This substitute is one that can be applied very often in repair shops or

factories, when the starting rheostat gets out of order. For a 100 h. p. motor, a water rheostat of the dimensions given below will be quite satisfactory.

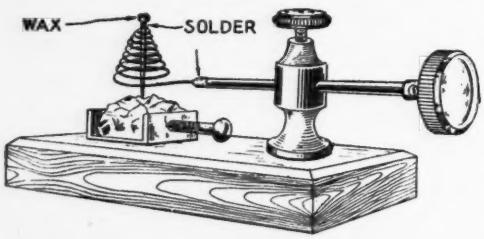
Assuming that the voltage is 110, so that the amperes on full load amount to 680, a fairly large-sized wooden cask is necessary, to allow for a proper dissemination of the heat which is produced by the heavy current. Accordingly, a large wooden cask is filled with slightly acidulated water—sulphuric will do—and an iron plate having four square feet of exposed surface bolted to one side of the cask in the solution. Another plate of the same dimensions is lowered into the water with a heavy, flexible, insulated cable. When it is completely submerged, a short circuiting switch is thrown in.

Hairspring of a Watch as a Detector-Point Support

THE illustration shows a home-made detector which may be helpful to those who do not need to construct a more elaborate instrument.

The hairspring of an old watch provides support for the point, and is an effective shock absorber. It is held by a drop of solder to the adjustment arm, which is bent at right angles after inserting it in its binding-post support.

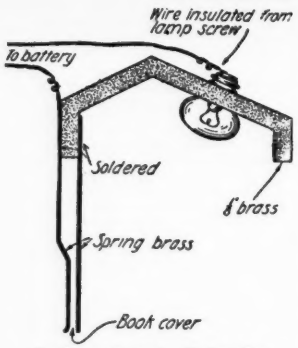
A one-inch length of annunciator wire is sharpened to a point for the crystal contact. Wind a few of the innermost turns of the spring around it, as shown in the drawing, and fasten with a well-placed drop of solder to avoid loose contact.



A length of wire pointed and supported by the hairspring for a crystal contact

If the conventional cup-type mineral holder is not to be had, a good clamp can be made very easily by bending up one side of a small piece of sheet brass as shown. Solder a nut taking an 8/32 in. screw directly opposite, and grip the crystal by tightening the screw on it.

Making a Miniature Light to Attach to a Book



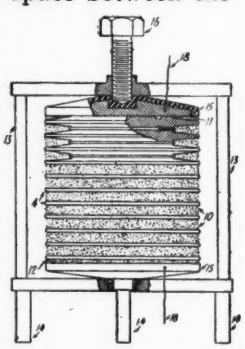
A tiny electric light for attaching to book covers

MANY a summer evening would be more enjoyable if one could sit on the veranda and read with only light enough to illuminate the book. The same is true in winter, when there is an open fireplace.

A simple book-light can be made by bending a strip of brass, ⅛ in. thick and 1 in. wide, as shown in the diagram. Bore a hole large enough to receive a miniature lamp, which should fit snugly. Attach two thin strips of brass (½ in. wide), to the other end of the first piece of brass to act as a spring, which can be slipped over the cover of the book. The wire connections are shown in the illustration.—WM. E. FINKERNAGEL.

An Airtight Quenched Spark-Gap

WHETHER or not quenched spark-gaps should be made completely airtight has often been a subject of dispute. The Telefunken gaps are usually fitted with plain mica separating-rings, and no great pains are taken to exclude air from the space between the sparking surfaces. In spite of this, the Telefunken transmitters as a rule operate efficiently and with uniform, clear spark-tones. The effectiveness with which a quenched-gap prevents "back-firing" depends to a large extent upon the condition of the parallel sparking-surfaces. If these are perfectly smooth and very slightly oxidized, the operation of the apparatus is usually most satisfactory. How long the plates will remain in good condition depends upon the material from which



Construction of De Forest's air-tight gap

the sparking-surfaces are made, and also upon the freedom with which air is admitted to the gap. Copper plates which are not provided with airtight gaskets soon become so thickly covered with oxides or compounds including nitrogen that gap action grows irregular; it is therefore desirable to exclude air from such instruments. When silver surfaces are used, the oxidization is not so rapid, and it is not necessary to take such precautions.

The drawing, which is taken from 1916 patent No. 1,171,598, issued to L. De-Forest, shows a method which has been found very useful for making quenched-gaps airtight. The structure comprises the usual plates 4, piled upon each other and clamped by means of screw 16 into containing frame 13. Electrical connection is made through the wires 18 which are connected to the clamping-heads 15. The novelty claimed for the present patent consists in the use, between the individual plates of the quenched-gap, of washers consisting of soft compressible varnished or impregnated fabric. When this material is clamped between the plates it effectually prevents the entrance of air, and so limits the formation of oxides upon the surfaces of the plates. Further airtightness may be secured by filling the space between the peripheral rims of the plates with a compound such as paraffin or beeswax, as shown at 10.

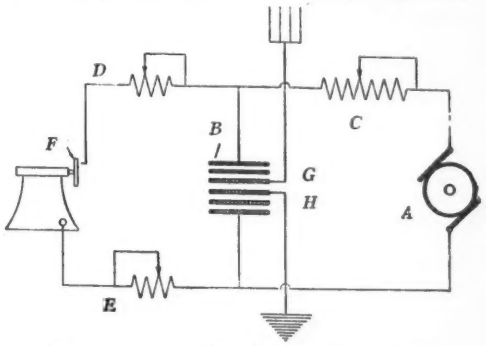
In building quenched-gaps of airtight construction, care must be taken that the normal cooling of the gap is not greatly reduced by prevention of ventilation. Also, in using compressible gaskets, the screw 16 must be carefully adjusted in order that the plates be not forced into accidental contact. If the necessary precautions are taken to insure permanence of separation of the plates, an airtight gap is likely to require cleaning much less frequently than one in which oxidization is permitted to progress freely.

Such an airtight quenched spark gap is especially useful on ships at sea and at any land stations which would be effected by the rapid action of salt air upon the material of the gap where it is heated by the spark.

In such a case a gap of this type will not only work more efficiently but will wear considerably longer.

Spark Sender for Sustained Wireless Waves

THE drawing shows a transmitter described in U. S. Patent 1,166,892, issued in 1916 to R. A. Fessenden. The high-voltage direct current dynamo *A* charges the outer plates of the condenser *B*, through the resistance or impedance *C*. The condenser discharges through the oscillatory circuit formed by the adjustable inductances in wires *D* and *E*, and the rotating spark-gap *F*. This gap consists of a stationary elec-



Fessenden's method for coupling the oscillatory circuit with that of the aerial

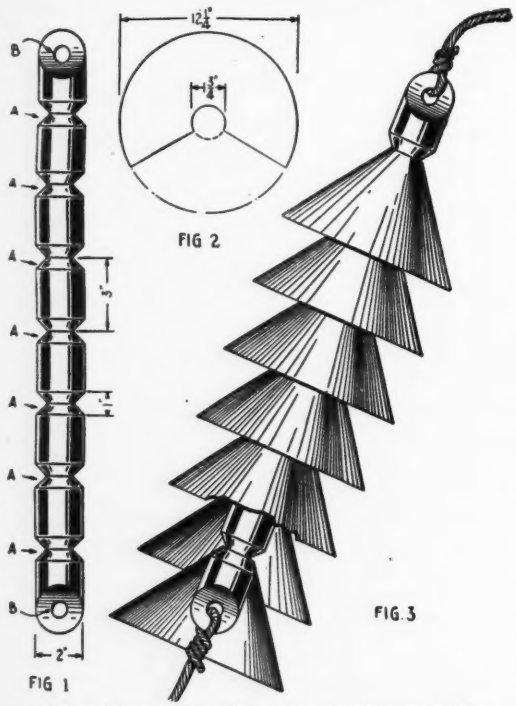
trode placed near to a disk which revolves at high speeds; the inventor suggests that the relative movement of the two sparking points may be as high as 12 miles a minute. The construction may involve two rotating disks, or some other mechanical form which will operate at very great speeds and so prevent the formation of any ark in the gap. In such an arrangement, the specification states, continuous and regular discharges are produced and sustained, or practically sustained waves are generated at high efficiency.

The mode of coupling to the antenna-to-ground circuit through the internal plates *G*, *H* of the sending condenser possesses some interest. This is equivalent in many ways to the static couple transmitters which have recently been tried in connection with various types of ark and spark generators. In order to secure good transfer of oscillating current energy from closed to open circuit it is necessary that the radiating circuit be in tune with the local circuit formed by the plates of *B* and the inductance in the lead wires *D*, *E*. This is accomplished by the usual insertion of variable inductance and capacity in the antenna circuit.

Strain Insulator Construction for Aerial Lines

THE accompanying illustrations show a method of constructing strain insulators which answer the purpose admirably.

Procure, for each insulator required, a piece of wood 1½ or 2 ft. long and 2 in. square. Chuck each piece in a wood lathe and turn them to 2 in. in diameter. At intervals of 3 in., turn V-shaped grooves *A* Fig. 1, 1½ in. deep. Remove from the lathe and drill ½-in. holes *B* in the ends and trim them flat with a draw shave as shown. Soak the wood for at least an hour in a molten mixture of equal parts paraffin and resin, to which has been added enough black asphalt to color. Allow the mixture to penetrate the wood as far as possible. Cut circles 12¼ in. in diameter from cardboard. Holes *C* Fig. 2, 1¾ in. in diameter are cut out, and one-third of the remaining surface, represented by the dotted line, is cut away. These cardboard segments are

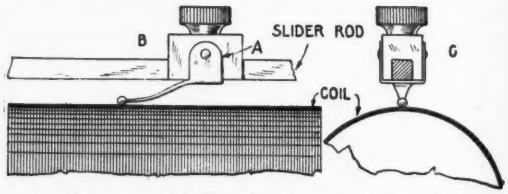


An insulator made of wood and cardboard disks then thoroughly soaked in paraffin and resin

then boiled in the above mixture until completely impregnated. Coil them around the grooves, allowing the edges to overlap ½ in., and fasten with thread as shown in Fig. 3. The completed insulator is now immersed in the insulating mixture until all cracks have been filled and air bubbles expelled, then removed and allowed to cool. It is practically impossible for a film of moisture to cover this insulator, even during damp weather.—H. W. OFFINS.

Making a Tuning Coil Slider from a Fountain Pen Clip

A VERY good tuning coil slider can be made from a fountain pen clip and a small block of wood with a hole in the lower



A slider, made from simple materials, which passes easily over the wires on a tuning coil

part of it for the slider rod. The sides *A* of the clip *B* should be bent into a square form so that they will fit around the block as shown at *C*. Tack the clip on the block, making sure that the bottom of the clip will touch the slider rod when it is mounted on the tuning coil. This is very important because the contact is made at this place. The arm with the knob on the end should be bent down until it touches the coil. A knob may be fastened on top of the block for convenience.—CLARENCE HUNT.

Detecting Defects in Castings with Magnets

DETECTING the presence of internal defects in iron and steel castings is accomplished by a current which is supplied from a small alternator to the primary winding of an induction coil, and which induces in the secondary winding a current which is passed through coils of two horseshoe magnets, mounted at a fixed distance apart and movable to and fro over the surface of the casting. The fields of both magnets will be affected uniformly if the structure is homogeneous. Defects, however, will disturb the lines of force from the nearest magnet. In a vibrating sounder, connected with a secondary coil on the magnet, the tone produced will differ in pitch from that given out from the corresponding sounder connected with the other magnet. Amplification of sound is secured by microphone attachments enabling the observer, by means of telephone receivers, to detect the locality of hidden flaws as the magnets are moved to and fro over the castings.

What Radio Readers Want to Know

Interesting and Instructive Questions and Answers

Loading Coil for an Aerial to Receive on Long Waves

W. L., Secaucus, N. J., writes:

Q. 1. I have an aerial 75 ft. in length, 18 ft. in height at one end and 25 ft. in height at the other end. Please state the natural wavelength. It has four wires spaced two feet apart.

A. 1. The wavelength of this aerial is approximately 165 meters.

Q. 2. Is it possible to load this antenna to the wavelength of 6,000 meters?

A. 2. For receiving purposes it is practical.

Q. 3. Please give the necessary dimensions for a loading coil for this aerial.

A. 3. Wind up a cardboard tube 6 in. in diameter, 24 in. in length, with No. 24 S. S. C. wire, and bring taps from the winding every inch. You will then have no difficulty in boosting the wavelength of this antenna to 6,000 meters.

Inductively Coupled Tuner of 11,000 Meters

M. D., Newark, N.J., inquires:

Q. 1. Please give me the dimensions for an inductively coupled receiving tuner to be adjustable to a wavelength of 11,000 meters. How many taps are required on each winding?

A. 1. The secondary winding of this tuner may be 15 in. in length, 7 in. in diameter, wound closely with No. 32 wire; the corresponding primary winding may be 7½ in. in diameter, 15 in. in length, wound closely with No. 24 S. S. C. wire. The turns of the secondary winding should be equally divided between the contact points of a ten point switch, while those of the primary winding may be wired either by means of two multipoint switches or by a sliding contact. For this equipment you should have two variable condensers of .001 microfarads capacity, one being placed in shunt with the primary winding on the receiving tuner and the second in shunt to the secondary winding.

Induction Interference from a Neighboring Motor

C. V. H., Kinsley, Kansas, writes:

Q. 1. We have been using a wireless set for the reception of time signals for over a year. During this period we have experienced no interference of any sort, but quite recently a garage about one block away installed a motor generator for charging storage batteries. When the batteries are being charged the induction is so bad we are unable to read a signal. The difficulty does not seem to lie with the motor generator, for the interfering noises are only heard when the batteries are connected thereto. Can you advise a remedy for our troubles?

A. 1. One thing is certain, when the motor generator is connected to the storage batteries there must be a fluctuation of the line current, and consequently it sets up inductive noises in your receiver. It may be that the commutator of the motor generator set sparks badly. A similar case of induction was eliminated in the following manner: The power leads from the motor generator to the storage battery were placed in an iron conduit and the iron conduit firmly connected to earth. In addition two condensers of two microfarads capacity each were connected in series and earthed at the center point. The other terminals were shunted across the storage battery.

Connections for a Three Slide Tuner with Other Apparatus

F. H. M., Richmond Hill, N. Y., inquires:

Q. 1. When do Sayville, Arlington, Tuckerton, and the Brooklyn Navy Yard send out messages, and what is their wavelength?

A. 1. The wavelength of Sayville is 9,400 meters; Arlington 2,500 meters for the spark set and 7,000 meters for the arc set; Tuckerton 7,400 meters; Brooklyn Navy Yard 600 and 1,000 meters. Sayville and Tuckerton may be heard any evening between the hours of seven and twelve P. M. eastern standard time, while Arlington may be heard at 12 noon and 10 P. M. eastern standard time, using the spark set at the wave of 2,500 meters. The Brooklyn Navy Yard communicates at irregular intervals with other Naval stations throughout the entire day.

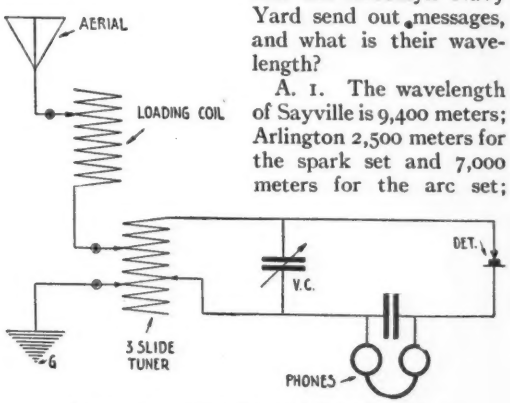


Diagram of connections for a three slide tuner, galena detector, loading coil, fixed condenser and variable condenser

Q. 2. Please give a diagram of connections for the following apparatus: Three slide tuner, galena detector, loading coil, fixed condenser, and variable condenser.

A. 2. Diagram of connections is shown above.

Polarized Relay as Interrupter

H. B. R., Monticello, Ga., inquires:

Q. 1. Please advise if an electro magnetic polarized relay will work successfully on 110 volt 60 cycle alternating current as a vibrator for an induction coil in the following manner: I propose to use two armatures each having a contact which makes connection with a stationary contact. Do you consider this feasible?

A. 1. It is believed that you will find it extremely difficult to adjust both contacts to interrupt the circuit of each coil if they are mounted on a single armature. However, by the use of separate armatures for each set of contacts the proposition is more feasible. Several experimenters within our knowledge have tried out the arrangement you suggest and have reported results considerably inferior to the ordinary induction coil vibrator.

Receiving on the Static-Coupled Tuner

J. M. S., Jr., New Castle Pa., writes:

Q. 1. Referring to the static coupled receiving set described on page 306 of the February issue of your magazine, what should be the dimensions of the coils L–1, L–2, and L–3, to make an equipment adjustable to 5,000 meters, and to be used in connection with an aerial 175 feet in length, 50 feet in height, composed of a single wire.

A. 1. The fundamental wavelength of your aerial is about 350 meters and all the inductance for the antenna circuit may be included in the coil L–2. Here a coil 3½ in. in diameter, 10 in. in length, wound with No. 26 S.S.C. wire will permit the desired value of wavelength. The coil L–2 should if possible have about the same dimensions. It can of course be made smaller, and a portion of the inductance included at the point L–1, but we see no reason for splitting it in this manner.

Q. 2. Is a crystaloid detector as sensitive as any crystal or electrolytic detector on the market?

A. 2. Many experimenters report better results from it than with the electrolytic. For the best results the stopping condenser of the usual circuit should be one of variable capacity and possesses values up to or beyond 0.005 microfarads.

Q. 3. How shall I connect a tikker in the statically coupled receiving set?

A. 3. Connect it in the circuit at the same point as the crystal detector *D*. The condenser *C*–2 should then have rather large values of capacity, as much as .05 or 0.1 microfarads.

Q. 4. What wavelength does Arlington use with the undamped wave transmitter, and should I be able to hear the signals of the statically coupled receiving set and a tikker.

A. 4. By careful adjustment of the circuits to resonance with the wavelength of 7,000 meters, you should be enabled to receive the signals in your home town, but the dimensions for the coils which we have given will not permit this circuit to respond to the wavelength of 7,000 meters. Increased values of inductance must be added at the coil *L*-1. We would advise a loading coil of No. 24 wire at *L*–1 approximately 8 in. in length by 3 in. in diameter fitted with a multipoint switch having taps about every half inch. You would obtain better results in the reception of signals from this station by using some form of the oscillating vacuum valve.

Ground Connections

P. L. K., Somerville, Mass., inquires:

Q. 1. What effect has a long earth wire on the range of a radio set? Does it decrease the range? Does it increase the wavelength?

A. 1. The earth lead is a part of the open circuit oscillator and consequently an increase in length of it increases the effective wavelength of the entire system. It is considered preferable in all radio installations, particularly as far as the transmitting apparatus is concerned, to make the earth lead as short as possible, otherwise the range of the apparatus will be seriously decreased.

Q. 2. I have an inverted "L" aerial 85 feet in length, 30 feet in height. The ground wire is 110 feet in length. Do you consider my ground wire abnormally long in proportion to the aerial?

A. 2. For transmitting purposes your earth wire is too long, but for receiving purposes the length is not so serious.

Q. 3. What is the natural wavelength of my aerial?

A. 3. About 300 meters.

Q. 4. How may I reduce the wavelength?

A. 4. By means of a series condenser or by decrease in the length of the earth lead. It is considered sufficient for receiving apparatus to connect the earth wire to water pipes inside the house.

Sending Condenser

G. D., Ligonier, Ind., writes:

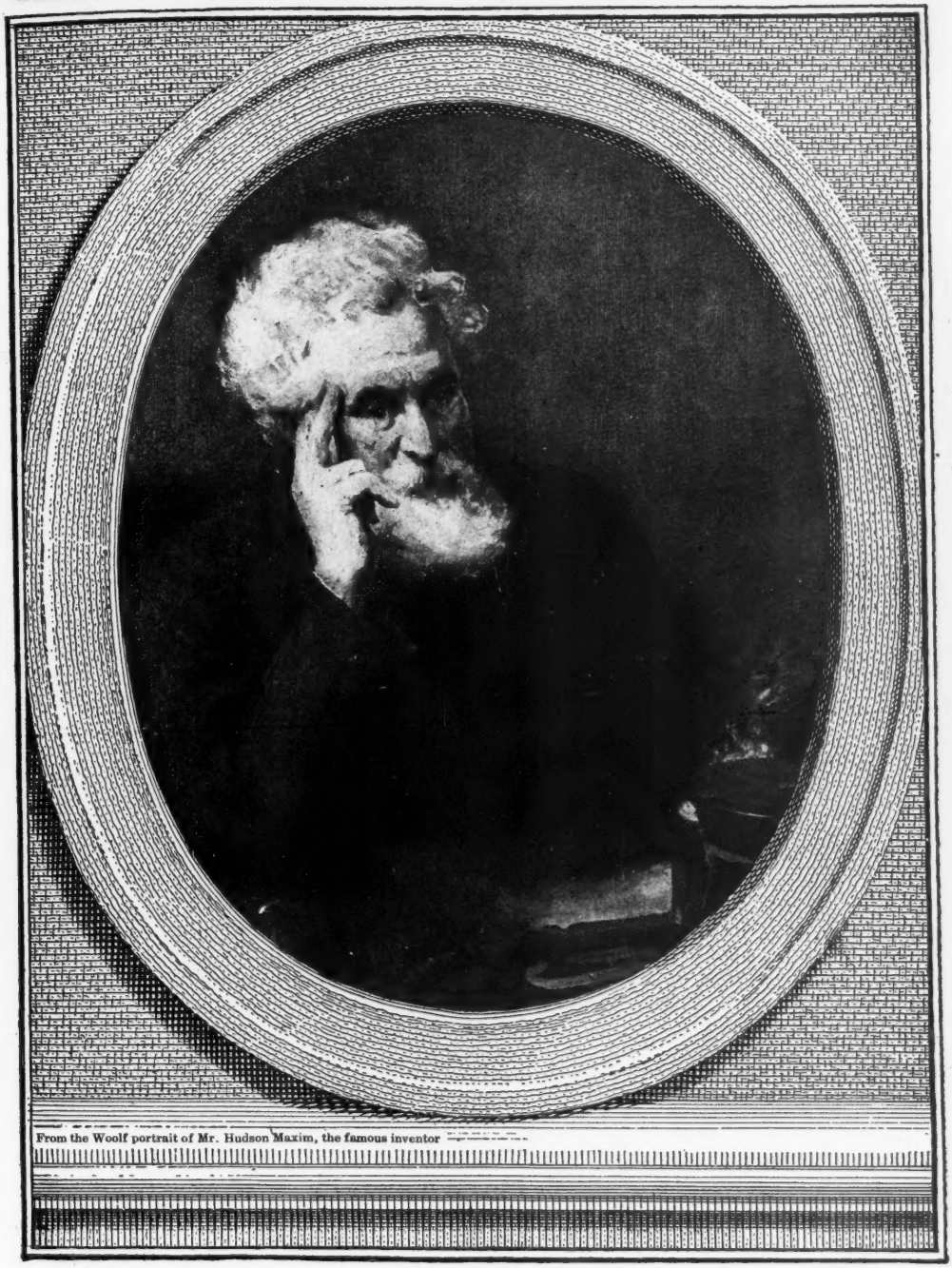
Q. 1. I calculate that in order to obtain a capacity of .008 microfarads, which I am told is the maximum value that can be used at the wavelength of 200 meters, I will require 25 plates of glass 3132 in. in thickness covered on each side with tinfoil 6 in. by 8 in. Is this correct? I fear that a single bank of these plates will not be able to withstand the voltage of the transformer. Consequently would it be proper to use two banks of 25 plates each connected in series? Furthermore, would this reduce the liability of puncture?

A. 1. Each plate of your condenser will have an approximate capacity of .00066 microfarads. Twelve plates connected in parallel will give you a value of .008 microfarads. Therefore a 48-plate condenser, 24 plates in each bank and the two banks connected in series, will give you the required value of capacity. The placing of two banks in series reduces the potential on the plates to one-half the value of a parallel connection.

Q. 2. Can you suggest any method by which the plates can be coated to prevent brush discharge without immersing them in oil?

A. 2. You might cover the plates with a good grade of beeswax or paraffin wax, but the best method of course is to immerse them in oil.

Hudson Maxim on the Popular Science Monthly



From the Woolf portrait of Mr. Hudson Maxim, the famous inventor

"The POPULAR SCIENCE MONTHLY makes useful scientific knowledge interesting. The newsiness of many of its features, the dashes of mechanistic adventure, the science touches of personal interest, make the publication, to my mind, of most exceptional value to the young men of this scientific and utilitarian age where every man must be a mechanic—where honor is earned and wealth and position attained with work-tired brain and grimy hand. The POPULAR SCIENCE MONTHLY is an especially good self-helper."

Hudson Maxim

Saving Valuables in a Shipwreck

What would happen if a ship equipped with the floating safes should founder in a heavy sea? Water would enter the shaft which holds the safes and would wash them overboard, where they would float until picked up by a passing ship. In this way the money, jewelry and other valuables of the passengers as well as the registered mail would be saved. At the right is a cross-sectional view of the ship showing the floating safes in position, one for each deck